AFIT/GCM/LAS/93S-8

POLLUTION PREVENTION INCENTIVES FOR MAJOR WEAPON SYSTEM PROGRAMS

THESIS

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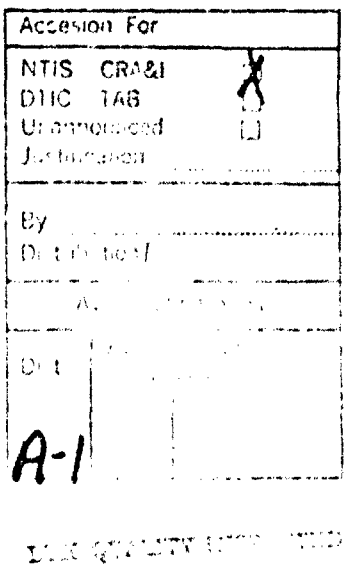

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THESIS

Presented to the Faculty of the Graduate School of Logistics and Acquisition Management of the Air Force Institute of Technology

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Acknowledgments

The purpose of this research effort was to identify incentives which will motivate both government personnel and contractors to incorporate pollution prevention into the early design phases of weapon system acquisitions. Pollution prevention provides an effective means of reducing costs associated with cleanups and civil liability through source reduction. Incorporating pollution prevention incentives in the early phases of the acquisition cycle would reduce potentially expensive remediation efforts in the future.

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Abstract

This research was undertaken to identify positive incentives that would motivate both government personnel and contractors to incorporate pollution prevention into the early design phases of weapon system acquisitions. The adoption and implementation of such incentives would allow the Air Force to reach its pollution prevention objectives more efficiently. A literature search revealed little information on the pollution prevention program in the military. In contrast much information was found concerning military cleanup activities. As a result, in-depth personal interviewing was used to measure pollution prevention awareness in Aeronautical Systems Center system program offices . Interviews, analysis and comparisons were made between three groups consisting of contracting, environmental, and strategic management personnel. Analysis revealed four main themes: program training; program funding; program structure; and contract incentives. Formal training and education on pollution prevention were limited. Current funding was done through existing resources. This had a potential detrimental effect on normal programming. The structure and philosophy of the current pollution prevention program are in preliminary stages, but it is progressing. Finally, positive incentives were not being used to motivate government and contractor personnel to design in more environmentally safe materials.

POLLUTION PREVENTION INCENTIVES FOR MAJOR WEAPON SYSTEM PROGRAMS

I. Introduction

General Issue

National defense and environmental protection are not mutually exclusive goals. The Department of Defense's (DOD's) mission to provide national defense appears to contradict their desire to be good environmental stewards. However, it is becoming increasingly obvious that national defense and environmental protection are complementary, not contradictory, goals. The environment is a precious national resource that needs defending by the military. This view is reflected in the Nunn Amendment to the fiscal year (FY) 1991 DOD Authorization Act which "broadens the definition of national security to include threats to the environment (17:1)."

Failure to carry out environmental protection measures in weapon system acquisitions has had both an economic and operational impact. Economic and operational constraints impede DOD's ability to provide national defense, as it is newly defined. In FY93, DOD requested $3.7 billion to cleanup hazardous waste sites. This is a 28 percent increase over FY92's budget request and more than four times the 1987 request (2:3). There is an opportunity cost associated with funding cleanups compared to funding other

critical programs. For example, these funds could have bought two B-2s ($1.8 billion each), or twelve M1A1 Abram tanks ($3 million each). Further, operational supportability is constrained by cumbersome technical and legal procedures required to safely handle, transport, and dispose of hazardous materials (HM) during weapon system operations. Consideration of the HM problem in the weapon system development stage has value in that it may prevent significant deployment problems in the future.

For example, during development of the single-engine F-16, a requirement existed to provide emergency thrust during inflight engine failure. The requirement existed to enable a pilot, faced with a turbine failure, to temporarily gain control of the aircraft. After regaining control, the pilot could safely eject. Emergency thrust for the gas generator was provided by an oxidizer called hydrazine.

Hydrazine is extremely hazardous and has caused several fatalities. It is a poisonous, eye-burning liquid that emits toxic fumes at room temperature and will eat through most containers. Hydrazine requires special procedures and facilities to be maintained in the field for safe handling. During the initial fielding of the aircraft, DOD became acutely aware that maintenance facilities were not available to maintain the hydrazine chemical. Additional contracts were made to construct facilities and procedures were developed at a cost that was not initially planned for in the acquisition process (15:1;25:5). Additionally, "we are restricted on locations to deploy these aircraft because we lack specialized facilities to handle one small, but important component of an extremely complex

weapon system (25:5)." The point of this example is that material and manufacturing design planning in the development stage of a system drives the future maintenance and disposal costs. Integrating pollution prevention management in the development stage is a pivotal solution to successfully reducing operation and maintenance costs, and potential environmental hazards.

Pollution prevention is the key to resolving the economic and operational constraints involved in handling HMs. Given proper pollution prevention diligence early in the development stages, weapons in the field can be more effective.

> Factories building weapons would be better prepared for mobilization if they hadn't been contaminated in peacetime. ...skilled technicians would be ready to replenish supplies if they hadn't been poisoned. Combat and support personnel could react faster, concentrate better, and be more effective if they didn't worry so much about hazards of transporting, handling, and using their weapons (25:4).

As congressional fiscal support dwindles, DOD needs to look at the long-term cost savings of pollution prevention. Attention to the operational impact of reducing hazardous waste in current acquisitions needs consideration.

Problem Statement

Mr. Thomas E. Baca, former Deputy Assistant Secretary of Defense (Environment), defined the DOD corporate strategy in a cradle-to-grave concept. "DOD must incorporate environment into the acquisition process--from concept development to operation and eventual disposal. We must stop pollution at the source (2:6)." This research effort will determine what changes

to contracting methods in major weapon system acquisitions are necessary to assure implementation of the Air Force's pollution prevention initiative.

Research Objectives and Investigative Questions

The goal of this research is to identify incentives which will motivate both government personnel and contractors to incorporate pollution prevention into the early design phases of weapon system acquisitions. To reach this goal, the following research objectives were developed:

1. Examine current pollution prevention strategies and procedures in the major weapon system acquisition process to determine the programmatic framework set in place for achieving the Air Forces' environmental objectives.

a. What steps are taken during the acquisition cycle to reduce or eliminate hazardous waste?

b. What incentives, if any, are used during each phase of the acquisition cycle?

2. Determine what elements in the programmatic framework and what contracting incentive(s) can be adapted to assure the goal of the pollution prevention program is realized.

a. What programmatic elements can be changed or what incentive(s) can be developed to motivate government personnel to meet the goal of the pollution prevention program?

b. What potential incentive(s) can be developed that would motivate contractors to cultivate new technologies and design in more environmentally safe materials?

Scope and Limitations

This research was limited to two major United States Air Force (USAF) organizations. Specifically, Aeronautical Systems Center (ASC) offices at Wright-Patterson AFB, Ohio and the Secretary of the Air Force for Acquisition (SAF/AQ), Washington DC.

Several areas were not investigated during this research. DOD's and the Air Force's (AF) pollution prevention policies were not evaluated for adequacy and completeness. Current policy was discussed only as it relates to government and contractor roles. Additionally, this research did not evaluate government's performance regarding reduction of hazardous materials in weapon system design. Rather this research focused on determining the impact of pollution prevention policy on local weapon programs and offered possible contract incentives.

Definitions

The following key terms are defined and used throughout this report :

1. Acquisition Program: A directed, funded effort that is designed to provide a new or improved materiel capability in response to a validated need (6:2).

2. Award Fee Contract: A contract that uses an additional pool of money initially set aside for the contractor to earn provided performance is evaluated as better than satisfactory at the end of the specific evaluation period.

3. Hazardous Material (HM): The operational definition of HM is taken from Mitre Corporation's report on the Acquisition Management of Hazardous Materials (AMHM). Mitre Corporation defines HM as:

> Any material which is mission-critical to weapon systems acquired by the Air Force and because of the material's physical, chemical, or biological characteristics; quantity; or concentration may:
>
> (a) Cause or contribute to adverse effects in organisms or offspring;
> (b) Pose a substantial present or future damage to the environment;
> (c) Result in damage to or loss of equipment or property during the system's life cycle (development, testing, manufacture, operation, maintenance, modification, and disposal) (1:2-4).

4. Life Cycle Cost (LCC): The estimated total direct, indirect, recurring, nonrecurring, and other related costs in the design, development, production, operation, maintenance and support of a major system over its anticipated useful life span (20:3).

5. Major Defense Acquisition Program: An acquisition program that is designated or estimated by the Under Secretary of Defense for Acquisition to require:

(a) an eventual total expenditure for research, development, test, and evaluation (RDT&E) of more than $200 million in FY80 constant dollars (approximately $300 million in FY90 constant dollars), or

(b) an eventual total expenditure for procurement of more than $1 billion in FY80 constant dollars (approximately $1.8 billion in FY90 constant dollars) (6:2).

6. Major System: A combination of elements that will function together to produce the capabilities required to fulfill a mission need, including hardware, equipment, software, or any combination thereof. A system that is estimated by the Under Secretary of Defense for Acquisition to require:

(a) an eventual total expenditure for RDT&E of more than $75 million in FY80 constant dollars (approximately $115 million in FY90 constant dollars), or

(b) an eventual total expenditure for procurement of more than $300 million in FY80 constant dollars (approximately $540 million in FY90 constant dollars) (5:3).

7. Nonmajor Defense Acquisition Program: A program other than a major defense acquisition program or a highly sensitive classified program (DOD 5000.1:2).

8. Pollution Prevention: Reducing the amount of unwanted wastes and pollution generated by manufacturing processes, so there is no handling, treatment, or disposal required (12:33).

9. Source Selection: The process wherein the requirements, facts, recommendations, and policies relevant to an award decision in a competitive procurement of a system/project are examined and the decision made.

10. System Acquisition Process: The sequence of acquisition activities starting from the agency's mission need identification and extending through the introduction of a system into operational use (20:3).

11. System Design Concept: An idea expressed in terms of general performance, capabilities, and characteristics of hardware oriented to operate as an integrated whole in meeting a mission need (20:2).

12. Value Engineering Change Proposal: A proposal that requires a change to the contract to implement and results in reducing the overall projected cost to the agency without impairing essential functions or characteristics, provided that it does not involve a change in deliverable end item quantities, R&D quantities, or the contract type.

Summary

This chapter has described the general issues, research problem, research objectives, investigative questions, scope and limitations, and key terminology appropriate to this thesis effort. The next chapter will review literature describing present cleanup initiatives, pollution prevention issues, and AF environmental policies.

II. Literature Review

Overview

Environmental literature focuses primarily on two central issues. They are: (1) hazardous waste cleanup and (2) pollution prevention. This literature review explores both issues as they pertain to Department of Defense (DOD) and United States Air Force (USAF). The discussion of cleanups serves as a background and drives the need for pollution prevention in weapon system acquisitions. The review concludes with a chronology of recent actions taken by DOD and the USAF to integrate pollution prevention into the weapon system acquisition process.

Hazardous Waste Cleanup

For decades, the DOD has hidden behind a facade of federal sovereign immunity and neglected to address environmental hazards present in the design, development, and operation of weapon systems. As a result, today's leaders are faced with the monumental task of cleaning up the past offenses of environmental contamination. To date, officials have identified 10,294 hazardous hot spots at 1,877 installations (23:68). Cleaning up these hazardous waste sites is proving to be a difficult and expensive task.

DOD's progress in cleaning up the numerous hazardous waste sites has been slow moving. The former Secretary of Defense for the Environment, Thomas E. Baca, noted that the DOD "is spending too much [time] on studies

and needs to advance to cleanups (11:26)." The biggest obstacle to the timely and proper cleanup of military hazardous waste sites has been a lack of adequate funding. A Pentagon study published in 1991 "projected $24.5 billion (1991 dollars) for environmental restoration over a 20-year period (4:48)." However, there are other issues contributing to the slow pace of cleanups.

Given their technological expertise, defense contractors who are most capable of venturing into the hazardous waters of federal cleanup activity see few incentives for doing so, and many disincentives. These disincentives include: (1) liability exposure, (2) limited funding, (3) low profit returns given the high risk, (4) the possibility of devastating adverse publicity if complications arise during performance of cleanup contracts, and (5) little prospect of retaining rights in data for new technologies developed in pursuing environmental work (19:888). One possible type of incentive would be to incorporate environmental compliance and innovation as a factor in source selection considerations. Currently, there are no requirements or incentives for contracting officers to consider environmental issues in the awarding of contracts. This is short-sighted and could likely be addressed with little disruption to procurement objectives (19:889). Future DOD environmental policy should focus on ways to erase the disincentives, while creating incentives, for defense contractors. These incentives should seek maximum compliance with environmental requirements while pursuing innovative technologies that can be employed in arresting and preventing environmental contamination (19:889).

Pollution Prevention

Historically, pollution prevention management has not been a concern for the DOD. However, this perspective has changed over the last decade due to the loss of sovereign immunity and acute awareness of DOD's pollution problem. Sovereign immunity was specifically waived in the 1992 Federal Facility Compliance Act amendment to the Resource Conservation and Recovery Act (22:1). Further, public tolerance of pollution has decreased as attention has focused on such incidents as Bhopal, Chernobyle, Valdez, Love Canal, and the Islip garbage barge. Faced with shrinking defense budgets and more stringent environmental laws, DOD is struggling with implementing comprehensive management approaches. Fortunately, commercial industries have been addressing environmental issues for some time because they were not immune from federal and state enforcement actions. Corporations who observe all laws and regulations by using sound environmental policies and practices are called green corporations (3:4). Commercial corporations can provide some reference for DOD in its effort to become a "green corporation."

Success stories such as 3M Corporation's 3P (Pollution Prevention Pays) program which won the Environmental Achievement Award in waste reduction in 1989 (21:56). Du Pont's acrylonitrile plant in Beaumont, Texas, brought about a "60 percent reduction in ammonium sulfate generation and an annual savings of $1 million in raw material costs and waste taxes (21:56)." These innovative companies and others realize that the cost of disposing hazardous waste demands designing pollution prevention into the manufacturing process

of their products. If there is little or no waste and consequently little or no disposal cost, then the company's profit is enhanced. As a result, pollution prevention considerations are rapidly entering corporate decision making.

Peter Winsemius and Ulrich Guntram, of McKinsey & Company, conducted an international research survey on the response to these environmental development challenges (26:17). Table 1 describes the typical development stages in corporate response.

TABLE 1

MCKINSEY'S CORPORATE RESPONSE DEVELOPMENT MODEL

Response Pattern	Stage 1 Reactive	Stage 2 Receptive	Stage 3 Constructive	Stage 4 Proactive
Integrate	End-of-pipe	Process	Product	Needs
Cooperate	Specialist	Managers	Industry	Society
Generate	Minimization	Optimization	Leap	Vision

(26:16)

Stage 1 is initially reactive in nature. Management reacts to a policy that is forced on them. Management itself does not take responsibility for environmental management, rather it is passed to staff specialists in a functional department. The corporation implements end-of-pipe solutions, or add-on features, to minimize their response and costs. Management does whatever is necessary to fix the immediate problem.

Stage 2 represents a small shift in corporate acceptance of environmental concerns. Line managers are now responsible for determining the most efficient production changes required to meet compliance standards.

This is similar to asking a flight line maintenance officer to resolve a residual waste runoff problem from an aircraft wash rack.

Stage 3 represents a corporate acceptance of environmental responsibility. Top management has adopted a cradle-to-grave approach to responsibility. Responsibility goes beyond delivery of a product. Eventual disposal becomes the responsibility of the corporation too. From suppliers to the government, corporations work together to facilitate joint goals for pollution prevention. Corporations search and develop better pollution methods through technological or organizational innovation. The McKinsey model identifies these changes as leaps in innovation.

Stage 4, indicates internalizing the goals set in Stage 3 through proactive quality management. Resources of the government, industry, and environmental organizations are pooled to resolve increasingly complex environmental issues. These resources will generate a vision to inspire further internalization of environmental challenges within the company. Winsemius and Guntram acknowledge that few international companies have reached this stage.

The McKinsey study provides insight into how corporations react to external and internal environmental pressures. They move from an operational to tactical to strategic mode of thinking as they progress through each stage. Integration of a DOD environmental strategy requires examining the development stages of corporate response to environmental pressures. Therefore, in the environmental arena, DOD action policies can and should

closely parallel those of a commercial corporations. From an analysis of the following DOD goals and initiatives, one can infer what stage of policy development DOD is currently in and can decide what strategy DOD should follow to enhance their pollution prevention policy.

DOD recently established four pollution prevention initiatives. They include:

1. implementation of all cleanup activities within 10 years;
2. full and sustained compliance with all federal, state and local environmental laws;
3. public outreach;
4. pollution prevention addressing all waste streams (2:3).

Financial resources of $3.4 billion (23:68) have been committed to the first two goals. When compared to the McKinsey corporate response model, the literature indicates DOD is concerned with accelerated cleanups and compliance.

In an Air Force (AF) action memorandum, signed by both the Secretary of the Air Force and the Air Force Chief of Staff, DOD's pollution prevention management initiative was codified into six AF objectives. They are:

> Objective 1: Reduce the use of hazardous materials in all phases of new weapon systems from concept through production, deployment and ultimate disposal - find alternative materials and processes, and measure their life cycle costs.
>
> Objective 2: Reduce the use of hazardous materials in existing (deployed) weapons systems by finding less hazardous materials and processes and integrating them into TOs [technical orders], MILSPECS [military specifications] and MILSTDS [military standards].

> Objective 3: Reduce hazardous materials use and waste generation at installations (civil engineering, vehicle and aircraft maintenance, administrative facilities, family housing, etc.) and Government Owned Contractor Operated facilities.
>
> Objective 4: Acquire state of the art pollution prevention technologies and distribute them throughout the Air Force.
>
> Objective 5: Apply new technology to pollution prevention; searching outside sources first, and conducting Air Force research where no alternative exist.
>
> Objective 6: Establish an Air Force investment strategy to fund the Pollution Prevention Program. (8:1-6)

Discussion of all six objectives is beyond the scope of this literature review. Objectives 1 is being aggressively pursued by Air Force Materiel Command (AFMC).

At AFMC, objective 1 is realized through a program known as Acquisition Management of Hazardous Materials (AMHM). AMHM incorporates hazardous material (HM) factors into the acquisition decision-making. Its purpose is to:

> institutionalize sound hazardous materials management practices within the weapons system acquisition process, with an aim to minimizing hazardous materials use and hazardous waste generation throughout the weapon system life cycle (1:xiii).

AMHM's goal is to assure future weapon systems will be designed and maintained more efficiently to prevent potential costly mistakes. Material design planning in the development stage of a system drives future maintenance and disposal costs. Integrating pollution prevention management early in development is pivotal to successfully reducing potential operation and maintenance costs.

AMHM implementation is crucial to the success of the AF's environmental objective 1. Using the life cycle costing (LCC) model provided in a AMHM computer program, system program offices can justify higher initial costs for a system that yield future long term cost benefits. The F-22 advanced tactical fighter program is the first program to incorporate hazardous waste reduction in all phases of the acquisition program. Phase III, Engineering and Manufacturing Development Phase, of the program addresses elimination of HMs where possible. It also addresses the LCC method (24:27).

AMHM success hinges on the motivation of the program manager (PM). A DOD IG inspection conducted between 26 November 1990 and 15 March 1991 identified this and 10 other problems. "Component acquisition managers are not considering life cycle cost/liabilities associated with the use of HM when making critical design decisions (14.5)." Appropriate emphasis by senior leadership is necessary to assure the AMHM tools are used effectively in acquisitions. This has partly been accomplished by participation of the Deputy Assistant Secretary of Defense for Environment on the Defense Acquisition Board Review (15:1;25:1). However, potential Pentagon reorganization by Secretary of Defense Les Aspin has not specifically addressed this function. Lack of senior leadership involvement in environmental concerns of the acquisition process will seriously limit AMHM's effectiveness.

In summary, McKinsey's four phase corporate response model was presented to show the parallelism and future potential for a sound pollution prevention program in DOD. DOD and the AF are progressing through each of

these development stages. AF has developed six objectives to implement DOD's corporate program. At AFMC, the new AMHM program is addressing issues identified in the McKinsey model. Through continued emphasis by senior leadership and internalization by government personnel, future weapon systems may be more cost effective and environmentally safe.

Chronology of Events

AMHM began out of a 1986 USAF Scientific Advisory Board (SAB) study.

> SAB found that the acquisition process did not include procedures to minimize the incorporation of hazardous materials in a system design, nor did it address the long term management of hazardous waste associated with the operation and maintenance phase of the system life cycle. In view of the growing economic and environmental impacts of hazardous materials, the SAB emphasized that the system acquisition process represents the first and most effective opportunity to manage hazardous materials (1:1-2).

Since 1987, when the joint logistics commanders decided to reduce the cost of hazardous waste disposal, DOD has worked to establish a more proactive environmental policy and has taken the first steps in implementing this new approach (24:24). The first step taken by DOD was in 1989 with the publishing of DOD Directive 4210.15, Hazardous Material Pollution Prevention. This directive made it DOD policy (7:1):

> ...that hazardous material shall be selected, used, and managed over its life cycle so that the DOD incurs the lowest cost required to protect human health and the environment. Emphasis is on less use of hazardous materials in process and products, as distinguished from end-of-pipe management of hazardous waste.

Then, in 1991, a framework for the DOD pollution prevention program was published in Part 6 of DOD Instruction (DODI) 5000.2, Defense Acquisition Management Policies and Procedures. DODI 5000.2 requires program managers, during the design and development phases of the system acquisition process, to identify and reduce hazardous waste associated with weapon system operation and support functions.

To develop implementation procedures for the requirements contained in DOD Directive 4210.15 and DODI 5000.2, the AF contracted with the Mitre Corporation to draft a model framework for AMHM. The Mitre Corporation model, provided to the Air Force in August 1992, included: an outlined infrastructure for establishing AMHM program technical responsibility; curriculum training materials; model statement-of-work language; and a LCC model.

The Air Force Pollution Prevention Program Policy Directive (AFPD 19-4) was published in October 1992. AFPD 19-4 outlines the Air Force goal to prevent future pollution by reducing HMs use and release of pollutants into the environment to as near zero as feasible. The program is based on several objectives: eliminating the purchase of ozone depleting chemicals; reducing municipal solid waste disposal; and reducing use of 17 priority chemicals identified by the Environmental Protection Agency as being widely used toxics that can be easily replaced (18:39). "Since approximately 90% of our hazardous material is for the maintenance of weapon systems, we are focusing efforts on the total life cycle of weapon systems: from concept phase through

ultimate disposal. Wherever possible, we will stop using a HM or provide a non-hazardous substitute (18:39)."

Draft AF regulations on several environmental topics were circulated at Air Staff on 18 December 1992. They are: AFPD 19-1, Environmental Management; AFPD 19-3, Environmental Compliance; AFPD 19-5, Installation Restoration; AFPD 19-6, Natural Resources Management. This effort represents a major attempt to provide current guidance to the field and to delineate responsibilities and goals to effectively demonstrate AF environmental leadership (13:1).

Conclusion

This chapter has looked at the historical issue of hazardous waste in DOD. The purpose of this overview was to lay the groundwork for pollution prevention in the weapon system acquisition process. Hazardous waste cleanup in DOD is both expensive and time consuming. However, pollution prevention provides an effective means of reducing costs associated with cleanups and civil liability through source reduction.

Commercial corporations have been dealing with the pollution prevention issue for decades. DOD can use their policy development experiences to develop its own pollution prevention program. McKinsey's four stage corporate response model was illustrated to provide insight into the evolutionary development of environmental policy.

DOD has recently established four pollution prevention initiatives. Subsequently, the Air Force developed six objectives to support DOD's initiatives. AFMC established the AMHM program to assure future weapon systems will be designed and maintained more efficiently.

The next chapter specifies the methodology used to identify actual and potential contracting pollution prevention incentives.

III. Methodology

Overview

Developing a research methodology on pollution prevention requires examining the sources and types of information applicable to the investigative questions listed in Chapter I. The methodology explained in this chapter examines the research design, sample design, survey method, survey instrument, pilot test, and data analysis processes. It describes the population's characteristics, defines the sample, specifies the variable relationships, and provides procedural steps to answer the investigative questions. Finally, the data collection plan and descriptive analysis procedures were elaborated. The desired result of the methodology chosen was to identify actual and potential incentives available as explained in the research objectives in Chapter I.

Research Design

This thesis effort consisted of an exploratory study which used a qualitative research design based on unstructured interviews to answer the investigative questions in Chapter I. Exploratory studies are conducted when "the area of investigation may be so new or so vague that a researcher needs to perform an exploration just to learn something about the problems (9:144-145)." The Air Force's Pollution Prevention Program is still in its infancy. Since the program is new, published data in the Air Force was limited. Information on how pollution prevention is actually implemented in major weapon system

acquisitions was not readily available or extractable. Further, respondents with education and experience in pollution prevention procedures were difficult to locate. As a result of these limitations, qualitative exploratory study was deemed appropriate for this research effort.

A qualitative research design consists of data appearing as "words rather than numbers...usually organized in extended text (16:21)" In addition, qualitative research is primarily an investigative process. "One makes gradual sense of a social phenomenon, and does it in large part by contrasting, comparing, replicating, cataloguing, and classifying the object of one's study (16:37)." In this research, we investigated the implementation of the newly formed Air Force Pollution Prevention Program. Logically, the most practical method of obtaining information on the actual and potential incentives was to secure the information from those directly involved with the process.

Sample Design

Two samples were identified in the acquisition population. The first sample consisted of contracting management and environmental management personnel at Aeronautical Systems Center program offices, Wright-Patterson AFB, Ohio. The purpose of this sample was to obtain knowledge regarding present pollution prevention procedures to determine if contract incentives are necessary, and to provide opinions on effective contract incentives. The second sample consisted of contracting, environmental, and acquisition experts from the offices of ASC/EMV and SAF/AQ. The purpose of interviewing this

sample was to discover the intent of the Air Force Pollution Prevention Program framework and to gain further insight on what contracting tools could be modified to provide incentives.

As stated earlier, the lack of published data and few experienced personnel was a prime consideration in developing this sampling plan. These considerations required a unique sampling procedure. Snowball sampling was determined as the most appropriate method. Snowball sampling is used "where respondents are difficult to identify and best located through networks (9:277;16:37)." A referral network was needed to obtain a sample. The network was progressively built by asking respondents for names of others who they felt were experienced on the subject of pollution prevention. Snowball sampling also provides uncommon flexibility in determining the sample. "Samples in qualitative studies can change. Initial choices of informants lead to the recommendation of new informants; understanding one relationship reveals several facets that have to be teased out and studied individually (16:37)." Sample size was another important consideration in this research effort.

The number of respondents in each sample was kept deliberately small. This allowed the survey to focus on depth of information over breadth; qualitative analysis over quantitative analysis. Further, qualitative analysis is time consuming and can not survey as many respondents. "Qualitative researchers usually work with smaller samples of people in fewer global settings than do survey researchers. Collecting data is a labor-intensive operation, traditionally lasting for months..." (16:15).

The small sample size does not necessarily represent the overall Air Force (AF) population of contracting, environmental, and acquisition personnel. Thus, the data gathered are not expected to be generalizable to the greater AF population. However, the vast majority of the population involved in major weapon system acquisitions are part of the sample. The nature of qualitative data analysis is almost always such that sampled data cannot be guaranteed to be generalizable with any finite degree of certainty (16:15-16).

Survey Method

Personal interviewing was chosen as the best survey method to conduct this research because it is an effective way to obtain rich detail and in-depth explanations. "The greatest value lies in the depth and detail of information that can be secured (9:320)." Since the available published data and number of respondents were limited, the personal interview carried certain advantages over other survey methods. First, it allowed the researcher to probe for answers to questions and use follow-up questions for more in-depth discovery. Second, researchers were able to screen potential respondents to assure they fitted the population profile (9:338-339).

Interviews were accomplished in two stages. In the first stage, the sample consisting of contracting management and environmental management personnel at ASC system program offices were personally interviewed. The respondent whose name was obtained through the referral network was contacted by phone, provided a short synopsis of the research purpose, asked

to participate in an hour long interview, and scheduled for an interview. To facilitate the discussion, these interviews were conducted using the advance questions, listed in Appendix A. During the interview, the interviewer followed the exact order of the advance questions. The respondents discussed their particular experiences with pollution prevention efforts in contracting for weapon systems. In the second stage, personal interviews were conducted with experts at ASC/EMV and SAF/AQ. They were initially contacted by phone, provided a short synopsis of the research purpose, asked to participate in an hour long interview, and scheduled for the personal interview. These interviews were based on the advance questions listed in Appendix B.

Survey Instrument Development

Data collection was accomplished using interviews with pre-written open and close ended questions. Probing was used to obtain in-depth answers when respondents' answers were superficial or needed further investigation. Most of the interview questions were open ended and were enhanced through the use of probing. Interview questions were constructed to answer the investigative questions identified in Chapter I.

Two survey instruments were developed and are listed in Appendices A and B. The first instrument was developed to address implementation of policies at the operational level in system program offices. Following both the completion of interviews with program office personnel at ASC and the analysis, a second instrument was developed. This instrument was directed at strategic

planners at ASC/EMV and SAF/AQ. "Instrumentation can be modified steadily to explore new leads, address a revised research question, or interview a new class of informant (16:37)." Consequently, the data gathered from personal interviews of the first sample at ASC system program offices was analyzed and used as a basis for developing the survey instrument for the second sample.

The survey instruments contained three types of information. First, demographic data to identify which sample the respondent belonged. Second, data to support investigative question 1a concerning the awareness issue. Finally, data to support the remaining investigative questions focusing on pollution prevention incentives. Thus, the variables for this research effort are: pollution prevention expertise, awareness, and actual/potential incentives.

Pilot Test of Survey

The survey instrument was pilot tested by interviewing faculty and students at the Air Force Institute of Technology (AFIT). These test respondents included students in the AFIT master's degree programs and the Systems 200 course who had major weapon system acquisition experience similar to the target population. The purpose of the pilot test was to assure validity and reliability in the measurement instrument and survey method. Further, the pilot test helped in refining the survey questions and provided the interviewer and recorder practice at interviewing. To help eliminate bias, both in the test and during the actual interviews, the same interviewer and recorder

were used. To help reduce bias and error in documenting responses, both the interviewer and recorder took notes and compared them after the interview.

Data Analysis Methodology

Evaluation of interview data generally requires the use of qualitative analysis. Responses found in interviews do not normally lend themselves to quantitative or parametric statistical analysis. The qualitative data obtained in the personal interviews was analyzed through the "clustering" of like data into a display known as a dendogram.

In clustering data, the qualitative analyst must decide how to arrange information into similar groups. In clustering information the researcher asks "What things are like each other? Which things go together and which do not?" (15:218) The answer to these questions leads to the development of categories/groupings which may be preexisting or may emerge from the data. When developing clusters, one moves through an iterative process which leads to higher levels of abstraction. The goal is to gain a better understanding of a particular phenomenon by grouping, then conceptualizing objects which are similar in nature. The results of grouping the data are then displayed in a dendogram.

A dendogram is a horizontal tree-like structure that shows groupings and different levels of abstraction. Each grouping is a result of using paraphrased of quoted material from interviews. The common theme running through each grouping was noted and placed together in branches leading to the main tree

structure which provides a conclusion. The end result of this effort is a dendogram structure which shows the common attitudes or comments with their varying degrees of similarities and differences. Figure 1 provides an example of how to structure a dendogram. A separate dendogram was accomplished per type of respondent in analyzing each specific survey question.

Matrix displays were used to analyze the data gathered from question seven of the survey located in appendix A and question five of the survey instrument located in appendix B. Matrix displays are the notation of patterns and themes in the data, finding meaning and "plausibility" in the patterns (16:216-228). The goal of the matrix analysis is to "identify a theme or pattern by isolating something (a) that happens a number of times and (b) that consistently happens in a specific way" (16:215). In this analysis, the matrix displays were built according to the multiple choice answers provided by the survey question. Specifically, the rows represented the multiple choice response and the columns represented the respondent.

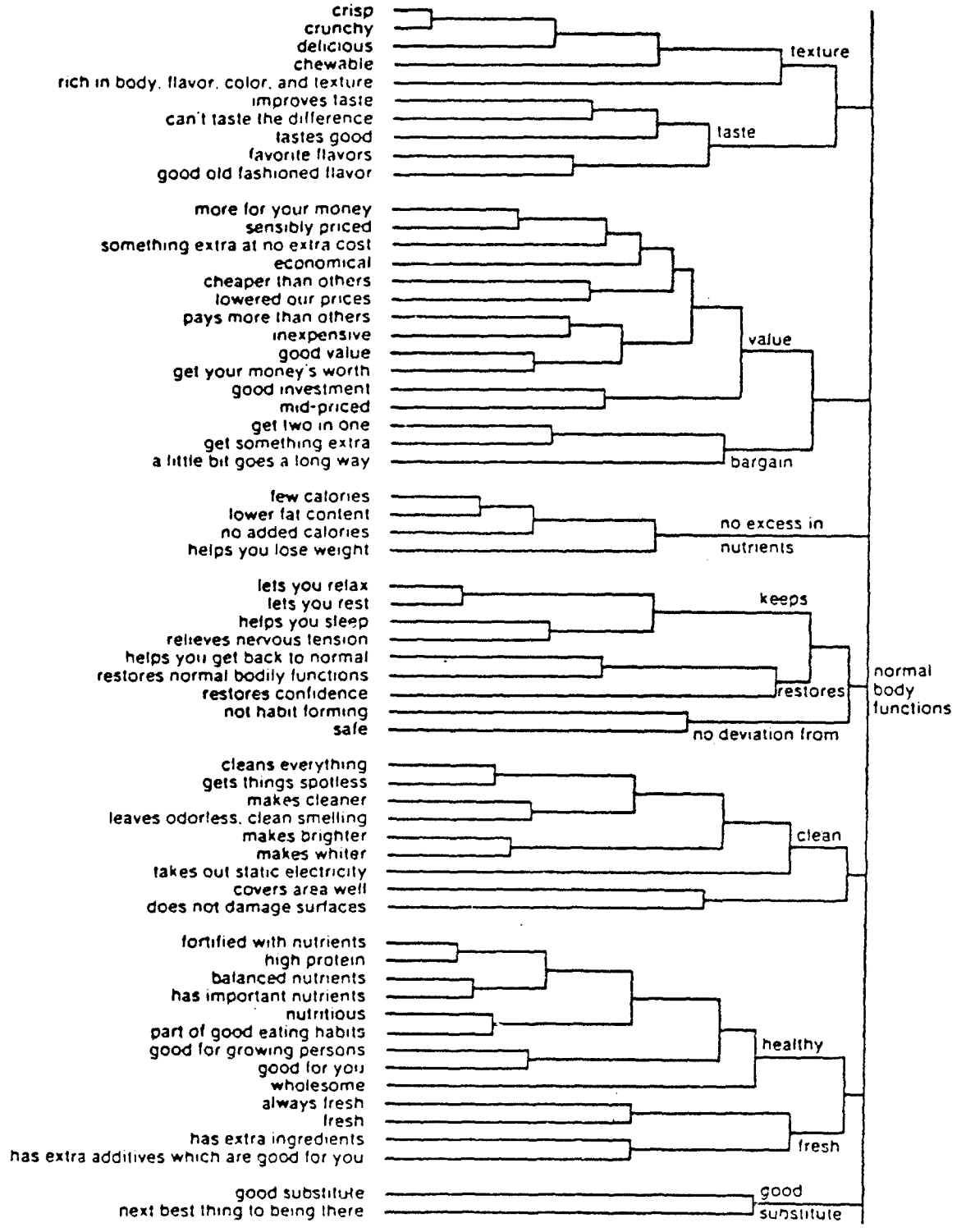

Figure 1. Sample Dendogram Structure (16:220)

In all interviews careful field notes were taken by both the interviewer and the recorder to assure correct data was obtained. These field notes were typed and edited to remove identifying information and extraneous comments. Once typed and edited, the interview data was transferred to the dendogram or matrix format, as applicable. The analytical methods of clustering and matrixing were used to analyze interview responses and draw the conclusions found in Chapters IV and V.

Limitations

Personal interviewing has several limitations. One limitation is the constraint of time and resources. It would be impossible to interview all the potential respondents at or beyond Wright-Patterson AFB, OH. This was not possible because of the geographical separation and number of individuals in the major acquisition work force. Therefore, the sampling design expressly limited the selections from the population. This sampling method makes logical sense considering the characteristics of the population.

Second, interview bias was a concern. Every effort was made to assure elimination of interviewer bias. The pilot test identified potential problems and led to revised questions. The test also provided the interviewer with training and constructive feedback. A second person, acting as a recorder, was used in the interviews as a comparative source of recording field notes and eliminating myopic interpretation by the interviewer.

As discussed earlier, the number of respondents in the sample was kept

deliberately small since the number of Air Force personnel with pollution prevention experience is limited. The small sample size also allowed the survey to focus on depth of information over breadth. The sample consisted of 13 respondents whose names were obtained through the referral network method. Initial names and organizations of environmental managers were obtained through ASC/EMV. Contracting management names and organizations were obtained through the environmental managers. Finally, the names of the strategic management respondents were obtained through informal contacts with Air Force Center for Environmental Excellence (AFCEE) at Brooks AFB, Texas, HQ AFMC/SGPB, ASC/EMV, and SAF/AQ.

Summary

This chapter explained the methodology used in this research effort. This research used an exploratory design method due to the lack of extractable information from AF sources. The Pollution Prevention Program is new and documentation is limited. As a result, the personal interview was determined to be the most appropriate method of securing information from those involved with the program. Two separate samples were chosen to get both an operational and strategic assessment of the program and its implementation philosophy. Interview instrument development included both open and closed ended questions to facilitate in-depth discussion through probing. Two instruments were developed. The first was for the operational personnel in the system program offices. The second instrument was derived from the

operational personnel interviews to draw on strategic perspectives on pollution prevention. Validity and reliability were prime considerations during the pilot test. The pilot test also provided interviewer and recorder training to eliminate bias in the interview process. The data analysis plan was developed using dendograms and matrices which grouped common themes together. These tools were used to analyze the data and draw conclusions stated in Chapters IV and V. The next chapter details the analysis of the responses found in the interviews.

IV. Results and Discussions

Chapter Overview

The purpose of this research effort, established in Chapter I, was twofold: (1) evaluate personnel awareness of pollution prevention and (2) determine the actual/potential incentives available for pollution prevention. This was accomplished by interviewing personnel in both the Aeronautical Systems Center (ASC) System Program Offices (SPOs) and the Pentagon. This chapter describes the sample selection and the analysis associated with answering the research investigative questions. It also describes the responses and presents visual analysis through the use of both dendogram and matrix displays. The end result of this chapter is to present findings which answer each investigative question.

Sample Selection and Limitations

The findings in this chapter are based on 13 interviews which were divided among three groups: contracting, environmental, and strategic management personnel. The interviews consisted of five contracting and five environmental management personnel and the remaining three were strategic personnel. The primary constraint in conducting these interviews centered around finding contracting personnel who were both knowledgeable about pollution prevention and willing to participate in the research effort. The original research intent was to interview the contracting and environmental managers

within each specific SPO to allow for direct comparison of pollution prevention knowledge. However, as the interviews progressed, locating contracting managers within the same SPOs as the environmental managers became infeasible. As a result, two of the five contracting managers interviewed came from ASC staff positions. This was necessary to get some type of contracting perspective regarding pollution prevention.

The pollution prevention experience level of respondents was small relative to their career field experience. All contracting personnel were of the civilian 1102 series or the military's 6534 Air Force Specialty Code (AFSC). Environmental personnel backgrounds reflected several different career fields and duty titles. Their backgrounds varied from systems safety engineer to logistical engineer to program manager. This provided a broad experience level of respondents. The strategic management personnel consisted of the same career make-up of contracting and environmental personnel. See Table 2 for the complete demographic data.

TABLE 2
RESPONDENT DEMOGRAPHIC DATA

	Career Field	Rank/Grade	Present Position (Years)	Career Field (Years)	Acquisition Phase
#1	AFSC 2895	Captain	4 months	4	Phase III
#2	AFSC 2835	Captain	1.5	22	Phases I-III
#3	AFSC 2721	1Lt	1.5	2	Phase III
#4	1101	GS-13	1.5	11	Phase III
#5	1102	GM-13	5	23	Phase II-IV
#6	1102	GS-13	2.5	16	N/A
#7	803	GS-13	2	9	Phase II
#8	AFSC 6534	Captain	2	8	Phase II
#9	1102	GS-14	1	16	N/A
#10	AFSC 2716	Major	3	16	N/A
#11	1102	GS-14	3	11	N/A
#12	AFSC 9126	Capt	2	9.5	N/A
#13	1102	GM-14	5 months	19	Phase II-III

Research Findings

This section provides the analytical results obtained by using both the dendogram and matrix display methods. A separate dendogram was written per interview question in order to group the information received by type of respondent. Every dendogram is not specifically addressed in the findings identified throughout this chapter, but all are located in Appendix C. The matrix displays were used to analyze the interview information provided for the final

question on each survey instrument. These matrices are located in Appendix D.

The two primary areas investigated were: (1) general awareness of the pollution prevention program and (2) actual/potential incentives available to both contractor and government personnel. Therefore, the findings are grouped and presented according to these two primary areas of investigation with the investigative questions being answered in chronological fashion. At the conclusion of each section is an interim summary which draws together the findings and directly answers each investigative question.

Awareness. The first part of investigative question one referred to SPO personnel's general awareness of pollution prevention issues and served as a foundation for understanding the pollution prevention process. The first four and the first eleven questions of the survey instruments located in Appendices A and B, respectively, were intended to solicit information regarding both SPO and strategic personnels' general awareness of the pollution prevention program. First, each SPO respondent was asked how pollution prevention was integrated into the acquisition cycle of their weapon system program (see the dendograms in Appendix C, pages 91-94).

While most SPOs had an environmental program, a comprehensive pollution prevention program was either just evolving or did not exist. In general, pollution prevention programs revolved around compliance related issues involving environmental laws. There were three significant themes for

this compliance orientation: (1) funding, (2) environmental law, and (3) program acquisition phase.

Funding is a significant problem as any initiative proposed by the government or contractor requires money. Any pollution prevention initiatives that have been adopted have come from existing funds that were intended for other program uses. Since full funding is difficult in today's era of tight resources, environmental managers have only been able to afford initiatives which are driven by environmental law. Anything beyond compliance has not been adopted because program managers have yet to budget for pollution prevention. This is caused by the inflexible budget process which requires a two year lead time to program funding. For example, estimates from the field concerning substitutes and redesign efforts caused by the ban on Ozone Depleting Chemicals (ODCs) will not be funded until FY95 at the earliest. Likewise, contractors are only motivated to ensure compliance with environmental law to prevent incurring penalties and fines. Therefore, contract management personnel's involvement in the pollution prevention program is solely related to ensuring their contracts comply with the ever changing environmental laws.

The maturity level of the acquisition program has also had a significant impact on environmental managers' ability to make cost, schedule, and performance tradeoffs when implementing pollution prevention initiatives. The acquisition phase also impacts the contract managers ability to modify contracts as is required by an aggressive pollution prevention program. Relatively new

acquisition programs have adapted to the pollution prevention challenge more readily than more mature programs. The lack of funds prevents pollution prevention clauses from being grandfathered into the contracts of more mature weapon system programs. As a result, only newer programs dealt with pollution prevention proactively by searching for guidance and when finding none developed their own. Contracting, environmental, and strategic managers indicated that supporting resources should be allocated so pollution prevention can be instituted early when the original request for proposal is issued in acquisition phases 0 and I. This is tc prevent costly redesign efforts which some SPOs are now facing in order to comply with the ODC ban.

In short, contract and environmental management personnel are concerned with the contractor's compliance of federal, state, and local environmental laws and are not actively pursuing pollution prevention in their contracts. However, the recent ODC ban has served to heighten contract and environmental management awareness needed to begin proactive implementation of the Air Force pollution prevention program. It is important to note that the slow but gradual move from a reactive to a more proactive stance is due to a lack of timely strategic program guidance and resource commitments. As noted by a strategic respondent, pollution prevention has received much media attention, but actual Air Force strategic efforts seem laissez faire. As a result, managers in the field have devised their own programs with little across the board information sharing and lessons learned.

The second and third questions on the survey instrument determined how program office personnel interfaced within the pollution prevention program and in what forums pollution prevention topics were discussed. The corresponding analysis is depicted in the dendograms on pages 95-101. Participation in meetings was the main source of awareness and knowledge regarding pollution prevention. Of these meetings, environmental working group (EWG) meetings were the primary vehicle for discussing pollution prevention. Proactive environmental managers were found in newer programs where design changes and resources such as funding were easier to obtain. Thus, they tended to serve as facilitators of new concepts and design ideas within the SPO by using their EWGs as action oriented forums for information sharing and problem solving. On the other hand, reactive managers were found in more mature acquisition programs in which they found themselves primarily reacting to new environmental policy through the hierarchy. Thus, reactive environmental managers saw themselves as information disseminators. This was due in large part to the fact that many of the reactive managers usually filled their pollution prevention role as an additional duty.

Even though most SPOs had an EWG established, at least on paper, the majority of the environmental managers information was garnered from informal contacts both internal and external to the SPO. For example, informal conversations with contractors by phone, side meetings, and E-mail were used to assimilate information that was distributed to SPO personnel.

Most importantly, contract management personnel participation in EWGs was negligible. This became evident since the organizational structure which would drive their functional participation is just being organized. As a result, contract management personnel were on the periphery of involvement in actual pollution prevention decisions. On the other hand, some contract management respondents did formally communicate through integrated product team (IPT) meetings and contact with the person responsible for environmental issues. However, the structure of the meetings and the frequency with which they met were slowly evolving and some contract management personnel did not know the point of contact for environmental issues. Again, this could be partially due to the fact that some environmental personnel were performing pollution prevention as an additional duty.

Strategic managers were asked a similar question in how they interface with SPO personnel and in what forums they discuss pollution prevention issues. Strategic management personnel used both formal and informal communication methods. Most communication was a direct result of directed policy guidance. After guidance would be received by the field, they would contact strategic managers by telephone for questions and interpretations. At the strategic level, the primary forum for discussing pollution prevention programmatic issues was various structured meetings. These included IPTs, EWGs, and a Defense Acquisition Review Subcommittee. The main concern respondents had at this level was the frequency at which the meetings took place. In some cases, the EWG meetings were not consistently running.

Conversely, the Defense Acquisition Review subcommittee was meeting at bimonthly intervals.

The final awareness question focused on the respondents' understanding of the pollution prevention program (see the dendograms on pages 102-105). When asked this question, all respondents answered with the issue of training. No formal pollution prevention training exists within any of the SPOs interviewed except for two of the SPOs which stated they did provide some on-the-job training and informal help as requested. Environmental managers indicated that what formal training exists external to the SPO focuses on remediation and has little pollution prevention. This is of little help to the acquisition community. Even though the courses are perceived to be of little help, it is of interest to note that while SPO environmental managers had received little training; their strategic counterparts had attended many environmental related courses.

Only one contract management respondent had received any pollution prevention training from either within the SPO or from external sources. Recent attention to the ODC ban has caused some compliance related on-the-job training for contract management personnel, but general training on pollution prevention has not occurred. This is supported by the strategic respondent within the contracting career field which stated that no contracting courses are available that address the pollution prevention program. The strategic respondent did note progress was being made to look at inserting pollution prevention into existing formal contracting courses.

Interim Summary. The task of analyzing the awareness issue is convoluted by the variety of responses received to the same question. However, certain similarities are apparent. The purpose of this interim summary is to provide a direct answer to investigative question 1.a., "What steps are taken during the acquisition cycle to reduce or eliminate hazardous waste?"

The Air Force Pollution Prevention Program is new and the mind-set has not moved from short-term compliance to long-term planning in the SPOs. Due to the fast pace of compliance oriented legislation, contracting and environmental management personnel are still wrestling with the fundamental issues of compliance. The recent ODC ban has accented this perspective. As the strategic management responses indicated, in order to move to a long-term planning orientation program offices must concentrate on minimizing hazardous materials through a priority program or through an economical life cycle cost (LCC) approach. The present inability to move to a long-term planning approach is partly dependent on the acquisition phase of the program.

Therefore, the second issue concerns the maturity phase of the weapon system. Clearly, all respondents believe that pollution prevention must start no later than the concept exploration phase. Unfortunately, there are few new programs in progress and the older programs must deal with pollution prevention from an after-the-fact perspective. New major acquisition programs were able to incorporate pollution prevention from the start. In fact, proactive solicitation of ideas and concepts were fed through IPTs and EWGs in these

program offices. To some extent, contractual language was used in the solicitation stage. Conversely, existing programs who are in the production and deployment phase are finding themselves reacting to the new policy and laws. These impacts are manifested in design changes causing increased costs and possible schedule delays. When possible, new request for proposals for upgraded weapon systems will include some type of contractual pollution prevention requirements, but the language is still in development.

Third, much training is being directed toward environmental cleanup and remediation of which the acquisition community has not attended. More importantly though, the acquisition community course needs for pollution prevention are not being met. Contract management personnel, in particular, noted an extreme lack of formal pollution prevention training. Some new initiatives are being developed. ASC is forming a three to four day pollution prevention course for acquisition personnel. This is in addition to the ASC awareness video already produced.

Meetings and informal contacts seem to be the most frequently used method of passing pollution prevention information along. Policy guidance is the least frequently used. Contracting, environmental, and strategic managers attend a variety of meetings that discuss pollution prevention. However, the infrequency of the meetings was stated as the major concern. Lack of consistent effective meetings indicated to the respondents a lack of interest with environmental concerns. Contracting management personnel are not involved in

EWG meetings as a functional representative. This is concerning due to the amount of information and changes established in EWGs.

Lastly, funding is a significant issue that hasn't been adequately addressed by strategic management or SPOs. This is partly due to the fact that the pollution prevention program is new and personnel have not incorporated programming decisions into their budgets. This is a critical requirement because pollution prevention will not be incorporated into weapon systems on a no cost basis. DOD and Congress must decide how much fiscal resources they are willing to allocate for pollution prevention in order to prevent a continuation of costly cleanups.

Incentives. The primary goal of this research effort was to identify incentives which will motivate both government personnel and contractors to incorporate pollution prevention into the early design phases of weapon system acquisitions. In order to reach this goal, this portion of the research focused on answering three of the four investigative questions, listed in Chapter I. These questions dealt with discovering what present incentives exist and what potential incentives can be adopted. The first five questions in the survey were intended to solicit information about what incentives currently exist and are used in each phase of the acquisition cycle. The findings which answer each of these questions is discussed in the paragraphs that follow.

When the surveyed population was asked how pollution prevention incentives are presently incorporated into their contracts, three common themes surfaced (see the dendograms on pages 106-108): (1) none exist, (2)

incentives exist, and (3) only "negative" incentives exist. The majority responded that their contracts did not contain incentives. In fact, two contracting management and one environmental management respondent saw no need for the government to use contract incentive provisions to motivate contractors to adopt pollution prevention programs. These respondents believed that state environmental law was becoming so strict there was little more the contractor could do to improve their manufacturing processes. Thus, an incentive was unnecessary for achieving and maintaining high environmental standards. One respondent also mentioned that any government incentive would be too small in value to have a major impact on the contractors pollution prevention efforts. Therefore, they saw no need for an incentive provision. This respondent further stressed that the competitive market should be incentive enough to achieve high environmental standards. They explained that the government would begin to only contract with contractors who were complying with environmental law and thus, the competition in winning a contract award would be enough to foster hazardous material elimination. These respondents preferred a laissez faire approach.

On the other side of the spectrum, a case did surface in which a pollution prevention incentive provision was implicitly contained in the contract. This was an award fee provision that included general pollution prevention criteria to reward the contractor's efforts in establishing and organizing a program and in meeting the contract requirements for hazardous material deliverables. This provision did not specifically compensate the contractor for

hazardous material elimination, but did reward the contractor for meeting the contract requirements regarding pollution prevention. In addition, a contracting management respondent did note that there have been many attempts by government personnel to develop special clauses, statement of work language, and data item description language to address pollution prevention in their contracts, but to date none had been used. These self-developed initiatives had not been used because the required approvals had yet to be granted.

Finally, both contracting and strategic management respondents noted the existence of "negative" incentives. There are several elements which are not specifically incorporated in the government and contractors binding agreement but which impact said agreement. These elements are considered to negatively incentivize the contractor to develop a pollution prevention policy in the course of fulfilling their contracts. These incentives are: local, state, and federal environmental law. Contractors are being held liable for violating these laws and thus, are now motivated to develop "clean" manufacturing processes to stay clear of lawsuits which could potentially bankrupt them. Another negative incentive placed on contractors is the federal government's threat to discontinue contracting with them unless their manufacturing processes are clean. An additional example is the threat of receiving bad press from the media regarding unsafe environmental practices.

In summary, the analysis of the data received regarding what incentives presently exist in contracts demonstrates that the government is doing little to positively motivate contractors to initiate aggressive pollution prevention

programs. Instead, the government is resting on negative incentives to get the job done.

The second and third survey questions addressed similar subjects of interest (see the dendograms on pages 109-112). That is, whether the government solicits pollution prevention ideas from contractors and whether contractors ever, of their own accord, identify pollution prevention initiatives to the government. All, but one, contracting management respondent stated that formal and/or informal channels were in place for contractors to offer pollution prevention ideas. In two cases, the government had used formal channels not to specifically solicit pollution prevention ideas, but to solicit proposals addressing a specific environmental issue. These were to draft proposals for identifying all hazardous materials associated with the contract and for what it would cost to "clean up" the contractors plant. In both cases, the contractors' proposals were too expensive for the government to award a contract for the action to take place. Additionally, two of the five environmental management respondents stated that they use formal contract channels to actively solicit information and ideas from contractors. In one case, there is an open and working two-way dialogue that occurs between the contractor and the government. The government keeps the contractor abreast of all draft Air Force policy and then questions the contractor on what impact the policy may have on the contract. Likewise, the contractor keeps the government abreast of any potential local and state environmental laws which may impact the contract. This open dialogue allows both parties to stay current on what may impact the

program so that they can proactively solve any environmental issues before they become problems. In the second case, the contractor and government are jointly attempting to solve the problem of finding a suitable substitute for an ODC which the weapon system can not function without.

The remaining contracting and environmental management respondents noted that ideas were not solicited, but that informal channels such as IPTs and the value engineering program could all be used in order to solicit future ideas. Even though these formal and informal channels are present for soliciting ideas, the majority of contracting management respondents had never seen a contractor independently identify a pollution prevention initiative. On the other hand, the majority of environmental management respondents noted that they had seen contractors offer pollution prevention ideas during regular and informal communications with the government. For example, a respondent noted an idea which their contractor offered in the course of an EWG meeting. This example was an initiative to stop using chemical lockers and instead issue smaller quantities of hazardous chemicals to workers with electronic check out cards. This method of issuing chemicals would not only reduce the amount of wasted chemicals, but would allow for better and easier tracking of what chemicals were being used and by whom they were being used. Thus, there would be reduced costs in the amount of material wasted and in disposal costs. Due to its cost saving ability, this idea was adopted. Another example of informal communication (bidder's conference) was where the contractor requested the government share in the burden of cleaning up the manufacturing

plant in order to comply with environmental law and avoid penalties and fines. The government agreed to this because the government contract specifications were partly responsible for the use of the hazardous materials.

Therefore, it appears contractors are not provided any direct motivation through any specific government actions, but are motivated by ideas that will either reduce their costs or help them ensure compliance with environmental law. As was demonstrated, two of these initiatives were identified because the contractor was being pressed to comply with environmental law which was in direct contradiction to what was required by the contract. To support this finding, the next survey question specifically asked respondents how the government was motivating contractors to develop and utilize new pollution prevention technologies (see the dendograms on pages 113-115). The majority of contracting, environmental, and strategic respondents stated they had never seen the government motivate contractors to develop and utilize new pollution prevention technologies. A contracting management respondent had seen the government motivate contractors through the use of two types of incentive provisions: award fees and the VECP clause. Note, this motivation was not specific to the area of pollution prevention. An environmental management respondent had seen the government motivate a contractor through the placement of an indemnification clause in the contract. This clause stipulated that the government would share in any increased costs which resulted from the contractor having to comply with any unforeseen environmental laws. This protection the government had afforded to the contractor does not specifically

motivate the contractor to proactively develop new pollution prevention technologies. It does, however, relieve the contractor of any unforeseen burdens which could gravely impact their ability to complete the government contract. Additionally, a strategic respondent had seen three situations in which the government had motivated contractors by allowing them to follow industry standards versus military standards in their manufacturing processes. This relaxation of restrictions on the contractor can be a primary motivator to explore the latest in pollution prevention technology. However, based on the majority of responses received, it appears the government is doing little to motivate contractors to develop new and cleaner technologies.

Since the government provides little direct motivation to contractors, respondents were asked what factors they perceive inhibit contractors from developing new pollution prevention technologies (see the dendograms on pages 116-118). Contracting management respondents noted a multitude of factors which inhibit contractors from developing new technologies. Most of the personnel interviewed were working with weapon systems which are in the later phases of the acquisition cycle. As a result, the acquisition phase was seen as an inhibiting factor. Once in the later phases of the acquisition cycle, initiating and implementing new pollution prevention technologies into current designs is much more difficult because it usually leads to costly redesign efforts which can also increase the targeted completion schedule to produce and deliver a system. Other inhibiting factors were environmental laws, unclear guidance, no pollution prevention requirements baseline, and inadequate funding. One

respondent's answer had an interesting twist. They were not sure that contractors are inhibited. They felt contractors had not focused enough attention on pollution prevention, not because they were inhibited, but because the governments focus over the past years had not been on pollution prevention. The government has focused on system performance and has only recently begun to look at pollution prevention so it makes sense that the lack of focus on pollution prevention is an inhibitor. This respondent's view was backed with a major theme noted by the strategic personnel interviewed. That is, strategic respondents noted the lack of emphasis and importance pollution prevention has received. In summary, the responses received from the contract management personnel demonstrate how pollution prevention has yet to be embraced as part of the long range planning process.

Two primary themes surfaced when the environmental management personnel were asked what inhibits contractors: (1) military specifications contradict sound environmental practices and (2) pollution prevention increases costs. Strategic respondents also voiced concern over the contradictory guidance provided in military specifications and standards. Military specifications call for the use of ODCs and other chemicals which are included on priority lists for elimination. Also, military specifications specify the use of harmful processes which contradict present environmental laws. This results in contractor confusion as to what the government wants. For example, what attention will a contractor give to minimizing and/or eliminating chemicals listed on the priority lists when the specifications call for their use? Another exampie,

is how can the contractor comply with laws and successfully complete government contracts which if followed to the letter would result in violations of law? This paradox demonstrates how the government's lack of flexibility in budgeting and revising military specifications is harming their ability to catch up with environmental law and their own stipulated pollution prevention philosophies. In short, pollution prevention has yet to become as important as the other "ilities" such as system maintainability, supportability, reliability, and so on.

Having looked at what factors respondents believed inhibited contractors from developing new pollution prevention technologies, the respondents were asked what policy changes they thought had to take place in order to overcome these inhibiting factors (see the dendograms on pages 119-121). The contracting management respondents stated that the Air Force should first focus on helping contractors get into compliance with present environmental law. This may never be totally possible considering the dynamic nature of environmental law. Second, the Air Force should focus on making pollution prevention an important aspect in its contracts by regarding it as another "ility" to be addressed in the acquisition cycle. Lastly, all pollution prevention efforts must be backed with adequate funding to encourage and enable contractors to meet their potential in this area. If implemented, the combination of these actions voiced by the contracting management respondents would overcome the inhibiting factors and result in full incorporation of the pollution prevention philosophy into its daily contracting actions.

The environmental and strategic management respondents' ideas were very similar to those of the contracting personnel. According to these respondents, pollution prevention criteria should be included as part of the source selection process, be a contractual requirement, and be listed as an evaluation factor in section "M" of the contract of the Uniform Contract Format. In order to make this happen, adequate funding to place pollution prevention directly into contracts must be obtained. A suggestion for funding pollution prevention initiatives in the interim is to utilize Advance Change Study Notice (ACSN) funds. The strategic respondents also expressed the need for the government to reward contractors for the research and development efforts in finding material substitutions and new cleaner processes. In short, the environmental management and strategic respondents ideas to overcome the inhibiting factors require the Air Force to specifically incorporate pollution prevention as positive inducements for contractor efforts in meeting these contractual requirements.

In order to answer investigative question 2.a., respondents were asked how they would incorporate pollution prevention into weapon system acquisition programs. The answers provided by the respondents resulted in four major themes of how to incorporate pollution prevention into weapon system acquisition programs (see the dendograms on pages 122-124). These four themes neatly flow into the following logical steps for incorporating pollution prevention. The first theme is to implement pollution prevention as an iterative process. Current regulations, military specifications, and technical orders

should be reviewed and updated to reflect the Air Forces' present pollution prevention philosophy. Then new regulations and/or policies should be adopted to direct Air Force personnel to regard pollution prevention as an important aspect of the acquisition process. Respondents stipulated that practical guidance on how to establish and monitor a pollution prevention program did not exist and as a result they felt they lacked the necessary training to build an effective program. Therefore, as these regulatory requirements are being met, personnel should be trained on how to write and evaluate pollution prevention specifications and contractual requirements. The second theme is to incorporate pollution prevention into the long term planning process. This can be accomplished by heavily weighting pollution prevention as an important factor in the first three phases of the acquisition cycle; by budgeting for it up front; and by establishing it as a contract requirement from the start. The third theme is to place pollution prevention in contracts through source selection and award fee incentive provision criteria. The fourth, and most important, theme is to make pollution prevention part of the rating and promotability standards set for program managers. This will ensure program managers administer the program as directed by policy.

Lastly, an important concern was expressed on the lack of information sharing regarding material substitutions. An example was given of a depot who refused to share information on a material substitution until they could complete a patent on the material. Thus, many DOD agencies may be funding duplicate

efforts to research and develop material substitutions. The respondent recommended a centralized database be formed with this type of information.

In answering investigative question 2.b., respondents were presented with a choice of four types of contract incentives and asked which they would choose to implement and why. The four choices were: (1) Award Fee, (2) Value Engineering Change Proposals, (3) Source Selection, and (4) Other. The responses given were grouped by type of incentive and are provided in the incentive matrices located in Appendix D. Note, that respondents did not come up with any incentives that would fit in the "other" category. Each incentive type is analyzed accordingly in the paragraphs directly below.

Award Fee Incentive. Two of the contracting management personnel believed an award fee provision would be the best and most powerful tool for rewarding contractors efforts at preventing pollution. Two other contracting management and one environmental management respondent believed that an award fee provision could work as a viable incentive if measurable, quantifiable, objective, and provable cost benefit criteria could be developed. They expressed difficulty in developing effective criteria that could be placed in an award fee provision which would serve to both reward and motivate the contractor for controlling pollution. The strategic management respondents offered suggestions on what criteria could be operationalized and used to measure or evaluate a contractors pollution prevention efforts.

An important opinion to note is that expressed by one of the environmental management respondents. This respondent stated the need to

place the pollution prevention criteria in the award fee on an equal footing with other criteria that impact program cost, schedule, and performance. For, cost, schedule, and performance criteria are where both the contractor and the government tend to focus their greatest attention. If pollution prevention is not equal with them, then it will lose out in importance and have little impact whether it is contained in an award fee or not.

Only one contracting management respondent was skeptical of using award fees as an incentive for pollution prevention. The respondent's experience showed that award fees rarely work as intended. Plus, the respondent thought there was a lack of funds to support award fees. Three of the environmental management respondents agreed. They thought award fees were too subjective and that the portion of the fee corresponding to pollution prevention would represent such a small percentage of the total possible fee that the pollution prevention criteria would have little impact in motivating contractors.

Value Engineering Change Proposal (VECP). Even though it appears VECP would be the easiest tool to implement, twelve of thirteen respondents suggested VECP not be used as an incentive for pollution prevention. Respondents felt the VECP clause would not work because it is a time consuming and cumbersome process that is rarely if ever used today. Thus, its use would do little to motivate contractors to cultivate new pollution prevention technologies.

Source Selection (SS). The majority of all respondents believed that the adoption of pollution prevention SS criteria could work as a viable incentive. However, most were unsure how to develop such criteria and how to subsequently evaluate contractors using the criteria. The strategic respondents and one each contracting and environmental management respondents offered some possible suggestions on how to do this. However, it is obvious that it would take great time, care, and hard work to establish some effective SS criteria. Also, as one respondent stated, even if effective SS criteria could be developed; it is unlikely that pollution prevention issues would actually sway a SS decision.

Interim Summary. The purpose of this interim summary is to provide direct answers to each of the three investigative questions using the findings associated with the incentives section. First, investigative question 1.b., identified in Chapter I, "What incentives, if any, are available in each phase of the acquisition cycle?" The findings of this research pointed to only one instance in which a pollution prevention incentive was implicitly contained in the contract. Furthermore, there was a trend indicating that many "negative" incentives exist for the contractor regarding pollution prevention. "Negative" incentives include: local, state, and federal environmental law; the federal government's threat to discontinue contracting with the contractors unless their manufacturing processes are clean; and the threat of bad press by the media. The research findings also indicated that the government does little to solicit pollution prevention ideas from contractors or motivate them to develop and

utilize new pollution prevention technologies. If ideas are initiated by contractors, this is usually because the idea will reduce costs or ensure legal compliance with environmental law. It is not due to any government efforts to motivate or solicit contractor ideas. Therefore, it appears DOD is resting on negative incentives versus positive motivation for contractors in order to meet the goal of the pollution prevention program.

Since the government provides little direct motivation to contractors, the research investigated what factors inhibit contractors from developing new pollution prevention technologies. Respondents noted a multitude of factors to include: acquisition phase, environmental law, unclear guidance, military specifications which contradict sound environmental practices, and inadequate funding.

Second, investigative question 2.a., "What programmatic incentive(s) can be developed to motivate government personnel to meet the goal of the pollution prevention program?" Regroup and implement the pollution prevention program as an iterative process by providing field workers with adequate regulatory and practical guidance and training on how to build an effective program. Second, provide field workers with adequate resources so they can incorporate pollution prevention into the early phases of their acquisition cycle. Third, provide the field with boiler plate source selection and award fee criteria for adaptation and placement in their contracts. Fourth and most importantly, make pollution prevention part of the rating and promotability standards set for

program managers. Lastly, develop a centralized data base for pollution prevention information sharing.

Third, investigative question 2.b., "What potential incentive(s) would motivate contractors to cultivate new technologies and design in more environmentally safe materials?" Respondents agreed that both source selection criteria and an award fee provision could be adapted to motivate contractors to cultivate new technologies. However, these two types of incentives would not be easy to implement. The respondents voiced concern over the ability to develop objective, measurable, and quantifiable criteria for both of these provisions. They further addressed concerns of evaluating contractors with the developed criteria. Yet, they believed the effort to adopt such criteria for each of these provisions was a worthwhile task to ensure the Air Force pollution prevention objective is reached. As was stated by one respondent, combining the use of SS criteria in evaluating a contractors ability to develop a pollution prevention program with the reward of their efforts in executing the program is the strongest incentive possible.

Lastly, even though VECP was not believed to be a viable incentive it must not be altogether disregarded. VECP is a vehicle that presently exists in most contracts and can be used by contractors to submit cost saving pollution prevention ideas.

Conclusion

This chapter began by examining the sample selection method and the limitations encountered within. The chapter then presented the analysis and findings related to each investigative question. This was accomplished by dividing the chapter into pollution prevention awareness issues and pollution prevention incentive issues.

Chapter V will present the conclusions drawn from the findings presented in Chapter IV and will offer recommendations in order for the Air Force to meet its pollution prevention objectives.

V. Conclusions

Chapter Overview

Chapter IV delineated the specific findings associated with this research effort. Chapter V offers conclusions based on the findings and recommendations for enhancing implementation of the Air Forces' Pollution Prevention Program. To do this, Chapter V will first address the conclusions arrived at from the findings. The conclusions consist of four areas in which managerial actions must be taken to rectify the problems uncovered in the course of the research. The four areas, listed according to importance, are: (1) program training, (2) program funding, (3) program structure, and (4) contract incentives. Secondly, the chapter will assess the maturity of the pollution prevention program by using the research conclusions and the McKinsey study growth stage model described in Chapter II. Lastly, the chapter offers recommendations the Air Force should implement to meet its six environmental objectives and continue to move progressively through each growth stage. More specifically, the recommendations address what programmatic changes should take place and what potential contract incentives can be adopted to ensure the goal of the pollution prevention program is realized.

Research Conclusions

Chapter I began with evidence to show that national defense and environmental protection are complementary, not contradictory, goals. The ability to provide adequate resources in order to build an effective fighting force is directly impeded by the Department of Defenses (DOD's) lack of past environmental protection. That is, the government is presently paying to cleanup its past environmental transgressions. With today's shrinking defense budget, the funding that is going toward environmental cleanups could be better spent on mission critical programs. As one respondent stated, "The number one threat against American weapon systems is not a foreign system. It is the drain on our budget caused by remediation and cleanup work. Our current resources should not be spent on cleaning up yesterday's mistakes but rather should be spent on developing new technology." Thus, pollution prevention must be implemented with speed and taken seriously to prevent future degradation of our nation's military forces. To ensure this takes place, this research effort identified four areas in which management should focus the attention of their pollution prevention efforts (see figure 2 on page 65). These areas include: (1) program training, (2) program funding, (3) program structure, and (4) contract incentives. The conclusions developed for each of these areas is discussed in the following section of this Chapter.

Training and Education. Training and education form the foundation of the awareness issue. General awareness of how to implement pollution

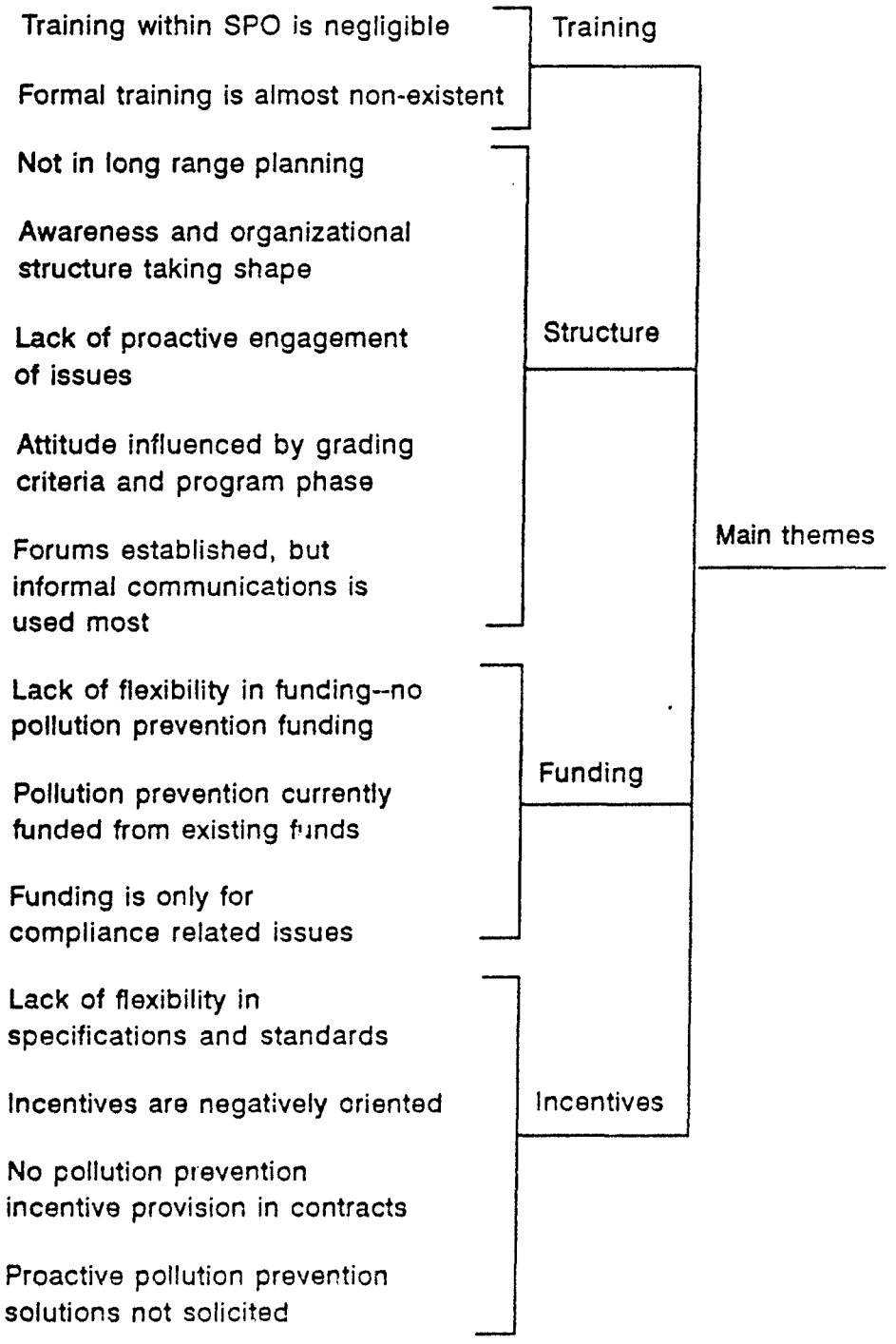

Figure 2. Summary Dendogram

prevention in acquisitions was not as high as expected. This lack of awareness can be partly attributed to inadequate training and education. Many respondents had not attended nor were they aware of the few formal environmental training and education courses presently offered. Personnel who were aware of and had attended courses noted the training was directed primarily at remediation with little regard to pollution prevention in the acquisition of weapon systems. This problem was being addressed by the USAF School of Aerospace Medicine and the Air Force Institute of Technology's current development of accredited pollution prevention training programs for acquisition personnel.

Specific functional training was another recurring theme. Contract management personnel indicated they had not received adequate training that represents the cradle-to-grave aspect of environmental protection. In fact, pollution prevention is not discussed in any contracting training forum. Environmental and strategic management personnel also indicated the need for more functional education regarding pollution prevention.

Program Funding. As pollution prevention is a new and evolving program, funding has yet to receive adequate attention by contract, environmental, and strategic personnel. Proactive pollution prevention programs only occurred on new programs. This was partially due to the fact that new programs were able to program the funding for pollution prevention early in the acquisition cycle. However, most Air Force weapon system programs are well beyond the initial acquisition phases. The question that has

not been sufficiently addressed is "How do these existing programs incorporate pollution prevention given their current funding levels do not provide for such an expensive endeavor?" To date, these existing programs have either not been funding pollution prevention initiatives or they have been funding them through one of two ways. These are through the expenditure of funds they planned to use elsewhere on the program and/or by using Advanced Change Study Notice funds. The initiatives which have received funding and thus been implemented deal with developing "cleaner" manufacturing processes in order to comply with environmental law. "True" pollution prevention initiatives, like developing material substitutions for the weapon system itself, have yet to be funded in existing programs. This is because law mandates the government fund requirements that will ensure compliance with environmental law while policy dictates the government fund requirements that will further the Air Force Pollution Prevention Program objectives.

Additionally, funding could pose a potential problem for the development and implementation of a pollution prevention contract incentive. Respondents noted that in order to incorporate pollution prevention criteria into the source selection process and eventual contract; adequate funding must be programmed and provided. Funding also has two potential impacts for incorporating pollution prevention criteria into an award fee provision. First, funding must be obtained to provide an award fee. Secondly, unless this amount of funding is sufficient to motivate a contractor to execute an excellent

pollution prevention program, the award fee provision will have little impact at enhancing the development of pollution prevention initiatives.

In conclusion, DOD and Congress must decide how much fiscal resources they are willing to directly allocate for pollution prevention. Thus, preventing the drain on the nation's economic resources caused by the need for costly environmental cleanups. This, in turn, will allow environmental management personnel and program managers to plan for and request pollution prevention funding through the budgeting process.

Structure and Philosophy. Reviewing all respondents comments and suggestions led to the development of three major themes regarding structure and philosophy. First, communications indicated that the current process is more reactive than proactive. Second, practical tools have not been provided to the field. Third, current improvements are implemented through a piece meal process rather than through an organized and integrative process. Each of these themes are briefly discussed in the following paragraphs.

First, current planning focuses on the short-term or compliance related issues rather than the long-term process of how to prevent pollution in weapon systems. This was indicated by a lack of funding for pollution prevention in terms of a long-term outlook and its importance as one of the "ilities" such as maintainability, supportability, and reliability. Additionally, cost, schedule, and performance parameters did not include pollution prevention as a high priority.

Second, program offices are having difficulty implementing pollution prevention because of a lack of knowledge on how to develop tools.

Specifically, the field is unsure of how to write pollution prevention specifications, standards, and statements of work (SOWs) to direct a contractor to incorporate pollution prevention in the development of the weapon system.

Third, an organized and integrative approach is lacking. Currently, each program office is looking for solutions individually without the benefit of a departmental or DOD interface. A centralized body of knowledge to help sponsor the crossfeed of information does not exist. As a result, individual system program offices (SPOs) which could benefit from lessons learned in other pollution prevention programs have no way of obtaining that information.

Contract Incentives. The findings of this research found only one instance in which a pollution prevention incentive was implicitly contained in the contract. Thus, one can conclude that positive contract incentives are not presently used to motivate contractors to develop pollution prevention programs and initiatives. However, the findings did point out that many "negative" incentives do exist which motivate the contractor to focus attention towards pollution prevention. These incentives include: local, state, and federal environmental law. The negative incentives cause contractors to focus on keeping their manufacturing processes "clean" and in compliance with environmental law. They do not foster contractor initiative to develop such pollution prevention ideas as material substitutions in weapon systems. Ideas such as material substitutions are what is needed by the government to reduce the weapon systems life cycle costs. Therefore, positive incentives implicitly contained in contracts do not exist and negative incentives do not operate to

ensure pollution prevention is designed into the weapon system itself. To overcome these issues, respondents were asked what potential incentive(s) would motivate contractors to design in more environmentally safe materials. The conclusion arrived at by the findings offered in Chapter IV to this question demonstrate that the combination of both source selection criteria and an award fee provision would provide the "strongest" incentive possible. However, the respondents also expressed how difficult it would be to develop both source selection and award fee pollution prevention criteria. Not only would the criteria be difficult to develop, but determining how to evaluate contractors regarding the criteria would also prove most difficult. Yet, they believed the effort to adopt such criteria for each of these provisions was a worthwhile task to ensure the Air Force pollution prevention objectives are reached. Therefore, the development of source selection and award fee criteria is an area which requires further investigation in future research.

Current Development Stage

The Air Force's Pollution Prevention Program is evolving through specific growth stages and is experiencing some growing pains with that evolution. Direct comparisons can be made to the four stage McKinsey corporate response model discussed in Chapter II and is presented on the next page.

TABLE 1

MCKINSEY'S CORPORATE RESPONSE DEVELOPMENT MODEL

Response Pattern	Stage 1 Reactive	Stage 2 Receptive	Stage 3 Constructive	Stage 4 Proactive
Integrate	End-of-pipe	Process	Product	Needs
Cooperate	Specialist	Managers	Industry	Society
Generate	Minimization	Optimization	Leap	Vision

(26:16)

Using the information provided in the interviews, two stages of development are clearly distinguishable. First, operational personnel in program offices are still in the Reactive Stage, stage 1, and have not completely reached the Receptive Stage, stage 2. Second, strategic managers are operating in the Constructive Stage, stage 3. In short, the speed at which the program evolution is progressing has left a developmental gap between operational and strategic management personnel.

The majority of comments received in the interviews indicated that many program offices are primarily in the Reactive Stage, stage 1. The McKinsey study defined the response patterns of this stage as a defensive orientation. Companies disagree with environmental regulation, but do comply as a "loyal citizen" is a characteristic of this stage. The responsibility for environmental issues are assigned to staff specialists, "usually as an extension to the existing health and safety departments." (26:17) With few exceptions, all environmental management personnel in charge of pollution prevention were assigned to the safety department in SPOs. Many of these personnel were also part-time

managers for their program. A full-time manager did not exist. Second, training was informal and a lack of formal training courses was clearly enunciated by the respondents. Third, much of their working issues dealt with compliance with laws or reactive to the recent impact caused by the ban on ozone depleting chemicals (ODCs). Further, some contracting management personnel indicated a hands-off approach to contract incentives by asserting that environmental legislation has effectively motivated the contractor to prevent hazardous material design and processes in weapon system development. Finally, management personnel in the SPOs, through their contractors, are responsible for design and production changes designed to meet only compliance standards and were funded in like manner. These pollution prevention initiatives were funded out of current appropriations meant for other needs. As a result, most programs interviewed had not initiated significant pollution prevention changes and were reactive in their responses.

The above response patterns directly correspond to stage 1 of the corporate response model. However, some responses by operational personnel showed a shift to stage 2. The McKinsey study defined the Receptive Stage, or stage 2, as a response pattern based on the corporation becoming more comfortable with new environmental responsibilities and delegating to line management the responsibility for developing solutions. In addition, this stage is characterized by solutions that optimize existing production configurations that may include process redesign (26:17). As previously indicated, newer programs were found to be more proactive in their

response to pollution prevention efforts than mature programs. Rather than concentrate on end-of-the-pipe solutions, these newer programs actively sought potential solutions to hazardous materials in the weapon system. At least one program had two designs on record until the substitute material could be determined to meet performance specifications. This response pattern more closely parallels the characteristics indicated in stage 2.

With operational personnel primarily in stages 1 and 2, strategic management's responses compare more closely to the Constructive Stage, stage 3. Stage 3 is characterized by a cradle-to-grave approach accompanied by technological and organizational leaps in development to meet high environmental standards (26:18). While actual implementation of strategic management comments are still being developed, responses did indicate a pattern comparable to stage 3. First, strategic managers were unified in their response by saying that the goal of the Air Force Pollution Prevention Program was to reduce the environmental impact caused by procurement of weapon systems. They indicated that pollution prevention is a long-term focus. Second, two respondents indicated that a life-cycle cost method is the most favorable method to operate a cradle-to-grave approach. Further, strategic managers indicated that pollution prevention was a high priority and was working with industry to effect necessary changes in philosophy both in and outside the Air Force. Finally, all indicated that more resources were needed to increase the level of commitment to pollution prevention.

A developmental gap unequivocally exists between the operational management level and the strategic management level. As stated earlier, the Air Force Pollution Prevention Program is relatively new. The development gap between the two groups indicates the momentum at which the program has been moving. Strategic management personnel need to be aware of and provide feedback to the field on current initiatives. The field, with the help of strategic management personnel, need to concentrate on developing the tools necessary to effect the pollution prevention considerations in their programs. A three to five year tactical and ten year strategic plan needs to be developed and communicated to both groups. As time progresses, the visions noted by strategic managers need to be internalized into the operational manager's business philosophy in weapon system acquisition programs. Current progress indicates that the pollution prevention program will succeed, however, increased attention and resources by policy makers needs to continue.

Recommendations

Training and Education. Training and education was a recurring theme in all the interviews. As noted earlier, general awareness of pollution prevention was low among contracting personnel. This is mainly attributed to the lack of training both informally in the SPO and formally through accredited courses. Environmental management personnel were more well informed, but they too noted that training and education was unsatisfactory for their needs. In

addition, neither of the two groups were well aware of what courses were available for pollution prevention.

Formal accredited pollution prevention training programs were being designed at the time of this research. To fill the training gap until the formal education courses are available, informal training programs are either being implemented or are about to be implemented. An example of this type of initiative is the ASC/EMV short video on pollution prevention that provides an overview of the Air Force pollution prevention goals and objectives. These stop-gap fixes are short-term solutions and are not designed as a comprehensive training medium. Thus, a continued emphasis on building accredited training courses is needed. Appropriate education and training programs should either be developed or incorporated into existing courses. This training needs to be functionally specific with a task oriented perspective on the actions required to implement the pollution prevention program in the acquisition of weapon systems. Future research efforts should be conducted in order to determine the exact course curriculum required in teaching pollution prevention to acquisition personnel.

Upon full development of courses, sufficient emphasis needs to be placed on getting the word to the SPOs that the courses are available. This can be accomplished through a direct marketing of the courses available to the acquisition community. The recent efforts which were underway to make personnel aware of current pollution prevention training should continue. For instance, The Acquisition Pollution Prevention Monitor recently listed available

courses within DOD (10:7-8). Three interim training course and five Air Force Center for Environmental Excellence and DOD courses are currently available. However, it should be noted that with the exception of two courses and the interim training courses, most are directed at environmental management personnel and engineers. None of the courses are directed at practical guidance for the contracting community on contractual requirements of pollution prevention.

Informal on-the-job training is also needed within the program offices. Environmental and contracting managers need to develop forums to distribute information on current and upcoming pollution prevention policy and its probable impact on the program.

Program Funding. The DOD must bring the importance of funding the pollution prevention program to the attention of policy makers and program managers must begin to place pollution prevention in their budgeting process. Presently, DOD is spending billions of dollars in environmental cleanup activities. With minimal resources available today, DOD must persuade policy makers of the need to begin funding pollution prevention activities up front or face paying more in future cleanup costs. Policy makers must realize the funding and integration of pollution prevention management in the development stage of the life of a weapon system is a pivotal solution to successfully reducing the systems life cycle costs and associated environmental cleanup costs.

To heighten the awareness of this need to policy makers, the Air Force should make their sixth objective: "Establish an Air Force investment strategy to fund the Pollution Prevention Program," their first objective. For the first five pollution prevention objectives can not occur without proper funding. There are several areas that require the receipt of adequate funding. First, funding is needed to bring on board the required number of personnel to run the program. This would keep pollution prevention from being an additional duty within major system program offices. Second, funding is needed to ensure the proper research and development efforts for identifying such items as material substitutions happens. Third, funding is required for the development and delivery of the required training programs identified in this research. Fourth, funding must be provided to existing programs in order to begin major redesign efforts that in some cases must now occur because of the ODC law. Fifth, funding is necessary to write pollution prevention program criteria into both new and existing contracts. Lastly, funding would be required for the adoption and implementation of future contract incentive provisions.

Structure and Philosophy. The following recommendations are based on the summaries mentioned at the beginning of this chapter. The three themes mentioned earlier lead to the corresponding three recommendations.

First, a fundamental philosophical change is required by acquisition personnel with regard to pollution prevention. This change must be from a reactive thinking mode to a proactive thinking mode. Most respondents were only working compliance related issues in manufacturing the weapon system

and not looking at long-term solutions. Compliance is a short-term problem that will only partially eliminate the hazardous materials and resulting pollution problems in the future. Acquisition personnel must focus more on pollution prevention in the system not just the manufacturing process. Pollution prevention goes beyond compliance by seeking more efficient and less hazardous materials and processes.

Pollution prevention is not considered as important as such "ilities" as maintainability, supportability, and reliability. Yet, pollution prevention can directly impact and constrain a program managers ability to successfully address each of these "ilities" required by DOD Instruction 5000.2. For example, operational supportability is constrained by cumbersome technical and legal procedures required to safely handle, transport, and dispose of hazardous materials during weapon system operations. Thus, pollution prevention should become equal in importance to the "ilities." This can be accomplished through the adoption of a strategic emphasis which demonstrates that the environment in general and, specifically, pollution prevention is a show-stopper. To establish environmental priority in acquisitions, respondents felt that strategic management should promote an environmental mission that is equal with the operational mission. In other words, pollution prevention needs to become as important as the cost, schedule, and performance parameters of the weapon system for any significant changes to occur. This will require programmatic guidance to address both the needs of established programs that will require expensive redesign efforts to meet the emphasis on pollution prevention and

new acquisitions programs. The maturity level of the acquisition is a significant constraint concerning the tradeoffs associated with the pollution prevention program. This drives the needs for early efforts in the first phases of acquisition.

Second, respondents indicated that several tools need to be developed and implemented. Several agencies have already begun developing effective SOW language. All Air Force acquisition personnel need access to these SOWs and furthermore need training on how to implement them in their own programs. Respondents noted the need to establish an Air Force or DOD database on hazardous materials and possible substitute materials. This would increase the ability to share valuable information. Further, current efforts to digitize and format military standards and specifications on CD-ROM media for access to hazardous material callouts needs to be completed to identify the conflicts with pollution prevention. Respondents indicated that these efforts are needed to organize and effect the changes to eliminate the contradictory guidance given to contractors by the government.

Third, the above programmatic issues must be resolved and implemented as an iterative process. When informal and formal feedback is received, efforts at continuous improvement need to be implemented. As indicated in chapter IV, the pollution prevention program in the Air Force is evolving. Pollution prevention methods will improve over time and these changes need to be incorporated into guidance for other weapon system programs. As environmental working groups and other management teams find

more effective methods of pollution prevention, the information should be shared globally within the Air Force and DOD. Future research should be conducted to determine what information needs to be included in the pollution prevention network system that will allow cross sharing of information.

Contract Incentives. As was stated in Chapter I, future DOD environmental policy should focus on ways to erase the disincentives, while creating incentives, for defense contractors. These incentives should seek maximum compliance with environmental requirements while pursuing innovative technologies that can be employed in arresting and preventing environmental contamination. Therefore, in order to motivate contractors to move beyond the development of cleaner manufacturing processes to simply comply with today's environmental law, a more proactive approach to motivating contractors must be designed. The motivation must serve to get contractors to design more environmentally safe materials into the weapon systems themselves. The findings and conclusions arrived at in this research point to the development and adoption of both source selection and award fee pollution prevention criteria as a contract incentive. As the Air Force works toward stabilizing the pollution prevention program, research on how to write and implement the best type of pollution prevention incentive should be conducted. Therefore, once the program has stabilized, the incentive will be ready for implementation. This future research effort should ask both government personnel and contractors what they believe will and will not work as a motivational tool.

Conclusion

This research was undertaken in an effort to identify incentives which would motivate both government personnel and contractors to incorporate pollution prevention into the early design phases of weapon system acquisitions. The primary intent was to identify contract incentives which could be used to positively induce contractors to design in more environmentally safe materials. The adoption and implementation of such an incentive would allow the Air Force to reach its pollution prevention objectives without having to develop and manage a program that would negatively force pollution prevention onto both government and contractor personnel. However, this research being an exploratory study had to focus more on the structure and operation of the Air Force Pollution Prevention Program. This focus was necessary to first gain a working understanding of the pollution prevention program prior to drafting an incentive provision. Now that the structure of the Air Force Pollution Prevention Program has been adequately studied, the next step for future research is to narrowly focus on the drafting and implementation of a contract incentive provision. In final conclusion, it must be noted that the sample size was small and consisted mainly of personnel located at Wright-Patterson AFB, Ohio. Therefore, the findings, conclusions, and research recommendations contained herein may not be generalizable to the larger Air Force.

Appendix A: Contracting and Environmental Management Interview Questions

INTERVIEWER INTRODUCTION:

Hello (person's name), I'm Capt Dudley Wireman and this is my partner Capt Donna Heinz. As discussed on the phone, we are AFIT students in the Contracting Master's Degree program and are interviewing you as part of our thesis research about pollution prevention.

We are interested in how the Air Force pollution prevention program works. Our research is sponsored by SAF/AQXM and focuses on two primary areas. They are current and potential pollution prevention incentives. As noted, your responses will be kept completely anonymous.

Do you have any questions before we begin?

Interview Questions

Part I
(Demographics: Experience)

1. What is your rank/grade (interviewer: circle one or write in)?

Capt	Major	Lt Col	Colonel	_____
GS-9	GS-11	GS-12	GM-13	_____

2. What is your position title?

3. How long have you been in your present position (interviewer: mark time on grid and write in number of years)?

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1          10         20
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4. How long have you worked for the Air Force as a (program manager, contracting officer, or system safety manager) (interviewer: circle the applicable career field embedded in the question and then mark time on grid and write in number of years)?

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|----------|----------|
1          10         20
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5. Is your program classified by DODI 5000.1 as a major acquisition program?

yes ____ no ____

6. What acquisition phase is your program presently in?

___ Concept Exploration and Definition
___ Dem/Val
___ EMD
___ Production and Deployment
___ Operations and Support

Part II
Research Objective 1
Pollution Prevention Program Awareness

1. Explain how pollution prevention is specifically incorporated into the program cycle of your weapon system.

PROBING QUESTIONS IF NEEDED:

a. In what ways are pollution prevention issues addressed during concept exploration?

b. In what ways are pollution prevention issues addressed during system design?

c. How do pollution prevention considerations impact system design?

d. Once a system is fielded, do you ever receive any feedback from the field regarding hazardous materials?

e. What type of feedback is usually received? How is the feedback handled?

f. How is feedback used in making future decisions on pollution prevention in the weapon system?

g. How is progress measured in the pollution prevention program?

2. How do SPO personnel interface with the pollution prevention program?

a. Who oversees the pollution prevention program?

b. What is their role?

3. In what forums is pollution prevention discussed in your SPO?

PROBING QUESTIONS IF NEEDED:

a. For example, is there a working group of some type that meets? If so, who are the members?

b. How often do they meet (Circle one or write in)?

As required, weekly, monthly, quarterly,

Annually

c. Who sets their agenda and how are the issues they discuss placed into action?

d. Other than the working group, can you think of any other forums in which pollution prevention is discussed?

4. How do you know personnel within the organization understand the pollution prevention program?

PROBING QUESTIONS IF NEEDED:

a. What environmental training exists within the SPO?

b. What environmental training exists outside the SPO?

c. Have you attended any of these environmental training courses? Which ones have you attended?

d. In what way has the training you and your subordinates received influenced your program?

Part III
Research Objective 2
Contract Incentives (Present and Future)

1. How are contracting incentives (motivational factors, rewards) for pollution prevention incorporated in your contract(s)?

a. What are these contracting incentives?

b. How do they work?

2. How are pollution prevention ideas solicited from contractors?

3. When designing a system, has a contractor ever identified pollution prevention initiatives to you?

   a. How were the initiative(s) handled?

   b. Was the contractor rewarded for their idea(s)? If so, how?

4. In the pollution prevention area, what do you feel inhibits contractors from initiating new pollution prevention technologies?

   a. Considering the constraints just discussed, what incentives could be developed to motivate contractors to design in pollution prevention?

   b. What changes would have to take place in order to implement your ideas?

5. In what ways have you seen the government motivate contractors to develop and utilize new pollution prevention technologies in the design of weapon systems?

6. If today, you were placed in charge of Air Force acquisitions, how would you incorporate pollution prevention into weapon system acquisition programs?

   a. In today's environment, what prevents your pollution prevention ideas from being incorporated?

   b. What changes would have to take place in order to incorporate your ideas?

7. Again, you are placed in charge of Air Force acquisitions. One of your staffers has briefed you on the following four possible contractor incentives. **(Interviewer: Hand the interviewee the sheet of paper with these incentives listed so they can read along with you)** These incentives would reward contractors for incorporating pollution prevention initiatives in their design and production of weapon systems. What form of incentive would you choose? Why? How would you implement your choice? Let's first discuss them one by one and then we can get into what you would do.

a. Award Fee Contract: A contract that uses an additional pool of money initially set aside for the contractor to earn provided performance is evaluated as better than satisfactory at the end of the specific evaluation period.

b. Value Engineering Change Proposal: A proposal that requires a change to the contract to implement and results in reducing the overall projected cost to the agency without impairing essential functions or characteristics, provided that it does not involve a change in deliverable end item quantities, R&D quantities, or the contract type.

c. Source Selection: The process wherein the requirements, facts, recommendations, and policies relevant to an award decision in a competitive procurement of a system/project are examined and the decision made.

d. Other: Any other ideas for incentives or combination/variation of the above.

10. Who else in or outside of your SPO would you recommend we interview?

11. Before we conclude the interview, is there anything that we may have missed that you would like to discuss further?

INTERVIEWER CONCLUDING REMARKS:

As we have previously stated, the information you have given us will be kept completely confidential. (Person's Name) again thank you for your time. Your responses have provided us with critical data we need to conclude our thesis. We are keeping a separate list of the people we interview so we can provide them with a summary copy of our research results. Would you like to receive a summary copy? Your copy of the summary results should reach you sometime in early September.

Appendix B: Strategic Management Interview Questions

INTERVIEWER INTRODUCTION:

Hello (person's name), I'm Capt Dudley Wireman and this is my partner Capt Donna Heinz. As you're aware, we are AFIT students in the Contracting Master's Degree program and are interviewing you as part of our thesis research about pollution prevention.

We are interested in how the Air Force pollution prevention program works. Our research focuses on two primary areas. They are current and potential pollution prevention incentives. Our purpose in interviewing you is to gain a strategic perspective on pollution prevention in the acquisition community. As noted, your responses will be kept completely anonymous IAW AFR 12-35.

Do you have any questions before we begin?

Interview Questions

Part I
(Demographics: Experience)

1. What is your rank/grade (interviewer: circle one or write in)?

Capt	Major	Lt Col	Colonel	_____
GS-9	GS-11	GS-12	GM-13	_____

2. What is your position title?

3. How long have you been in your present position (interviewer: mark time on grid and write in number of years)?

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1          10         20
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4. How long have you worked for the Air Force as a (program manager, contracting manager, or system safety manager) (interviewer: circle the applicable career field embedded in the question and then mark time on grid and write in number of years)?

Part II
Research Objective 1
Pollution Prevention Program Awareness

1. Who sets pollution prevention policy for DOD? For the AF?

Probe: (a) Who is the USDA/E? If not filled is this a help or hindrance to the pollution prevention program?

2. In your own words, what are the objectives of the AF Pollution Prevention program?

3. How do you see pollution prevention being incorporated into the acquisition of weapon systems?

4. What priority does pollution prevention have in the AF?

5. How do you know if the field is/isn't meeting the objectives of the pollution prevention program?

6. How do you interface with the field regarding the pollution prevention program? What is your role?

7. In what forums is pollution prevention discussed in DOD?

8. What kind of feedback have you received from the acquisition community regarding pollution prevention? How do you receive the feedback?

9. How is that feedback used in policy making?

10. What kind of pollution prevention training for acquisition are you aware of? Are any being developed that you are currently aware of?

11. What conferences/courses have you attended?

Part III
Research Objective 2
Contract Incentives (Present and Future)

1. What contracting incentives (motivational factors, rewards), if any, are you aware of that the field has used for pollution prevention?

   a. What were these contracting incentives?

   b. Were they successful?

2. What do you feel inhibits contractors from implementing new pollution prevention technologies?

   a. Considering the constraints just discussed, what incentives could be developed to motivate contractors to design in pollution prevention?

   b. What changes would have to take place in order to implement your ideas?

3. In what ways have you seen the government motivate contractors to develop and utilize new pollution prevention concepts in the design of weapon systems?

4. If today, you were placed in charge of a SPO, how would you incorporate pollution prevention into weapon system acquisition programs?

   a. In today's environment, what prevents your pollution prevention ideas from being incorporated?

   b. What changes would have to take place in order to incorporate your ideas?

5. Again, you are placed in charge of a SPO. One of your staffers has briefed you on the following four possible contractor incentives. **(Interviewer: Hand the interviewee the sheet of paper with these incentives listed so they can read along with you)** These incentives would reward contractors for incorporating pollution prevention initiatives in their design and production of weapon systems. What form of incentive would you choose? Why? How

would you implement your choice? Let's first discuss them one by one and then we can get into what you would do.

a. Award Fee Contract: A contract that uses an additional pool of money initially set aside for the contractor to earn provided performance is evaluated as better than satisfactory at the end of the specific evaluation period.

b. Value Engineering Change Proposal: A proposal that requires a change to the contract to implement and results in reducing the overall projected cost to the agency without impairing essential functions or characteristics, provided that it does not involve a change in deliverable end item quantities, R&D quantities, or the contract type.

c. Source Selection: The process wherein the requirements, facts, recommendations, and policies relevant to an award decision in a competitive procurement of a system/project are examined and the decision made.

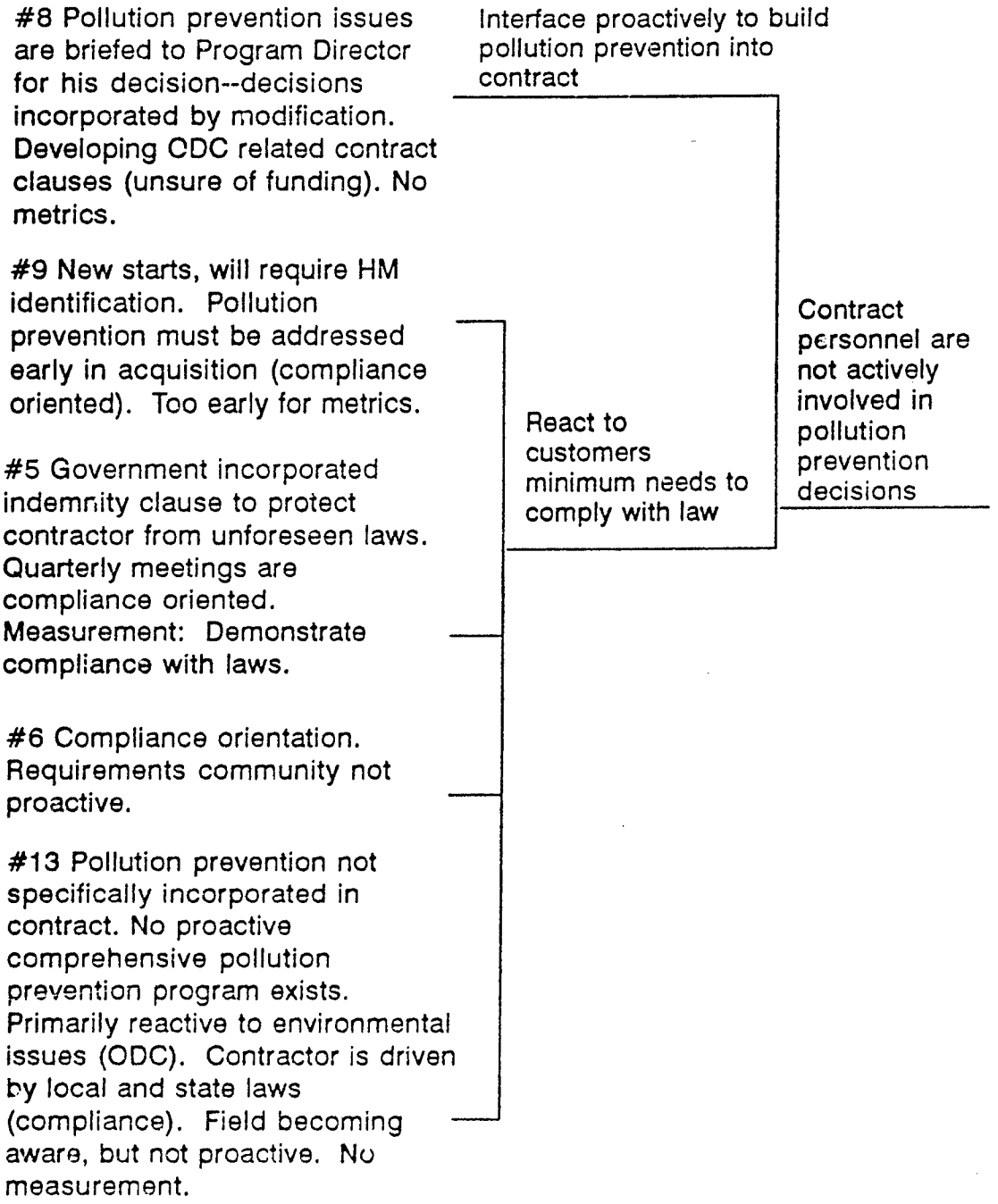
d. Other: Any other ideas for incentives or combination/variation of the above.

6. Before we conclude the interview, is there anything that we may have missed that you would like to discuss further?

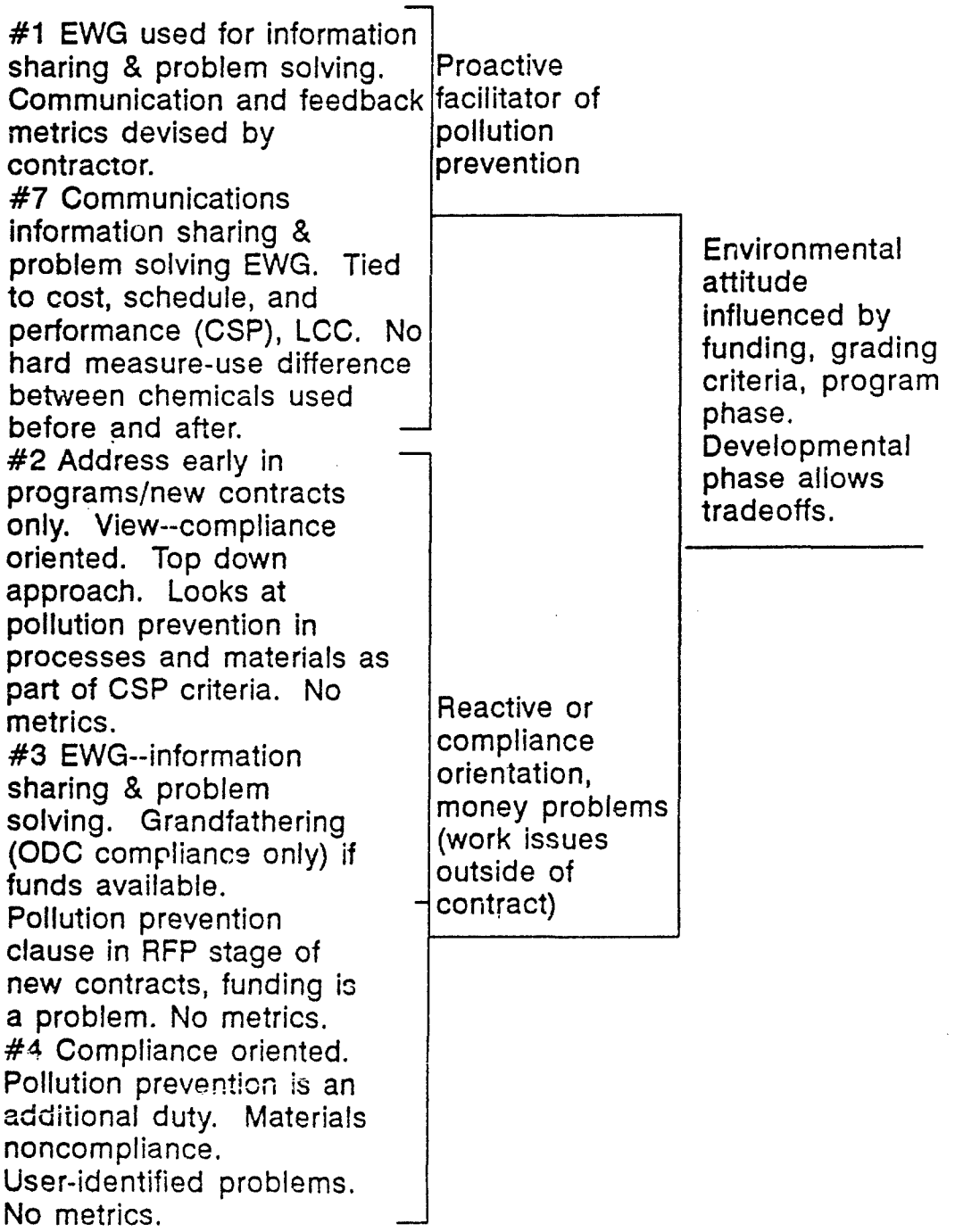
INTERVIEWER CONCLUDING REMARKS:

As we have previously stated, the information you have given us will be kept completely confidential. (Person's Name) again thank you for your time. Your responses have provided us with critical data we need to conclude our thesis. We are keeping a separate list of the people we interview so we can provide them with a summary copy of our research results. Would you like to receive a summary copy? Your copy of the summary results should reach you sometime in early September.

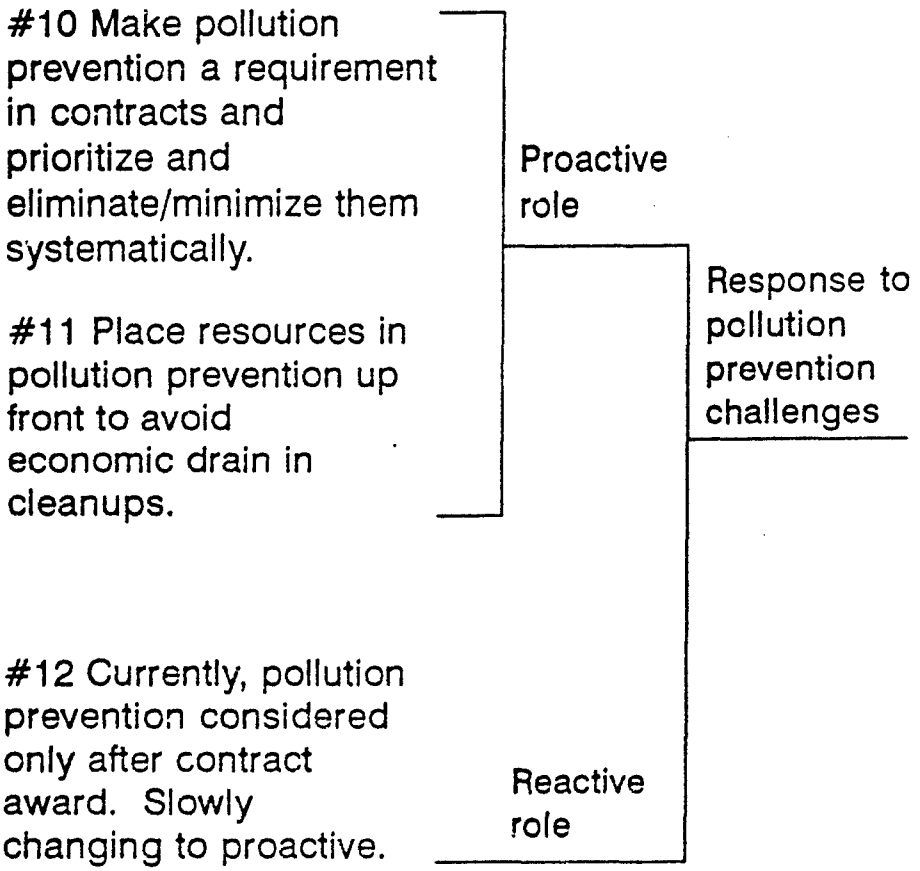
Appendix C: Dendogram Analysis
Awareness Question 1-Contracting



Appendix C: Dendogram Analysis
Awareness Question 1-Environmental

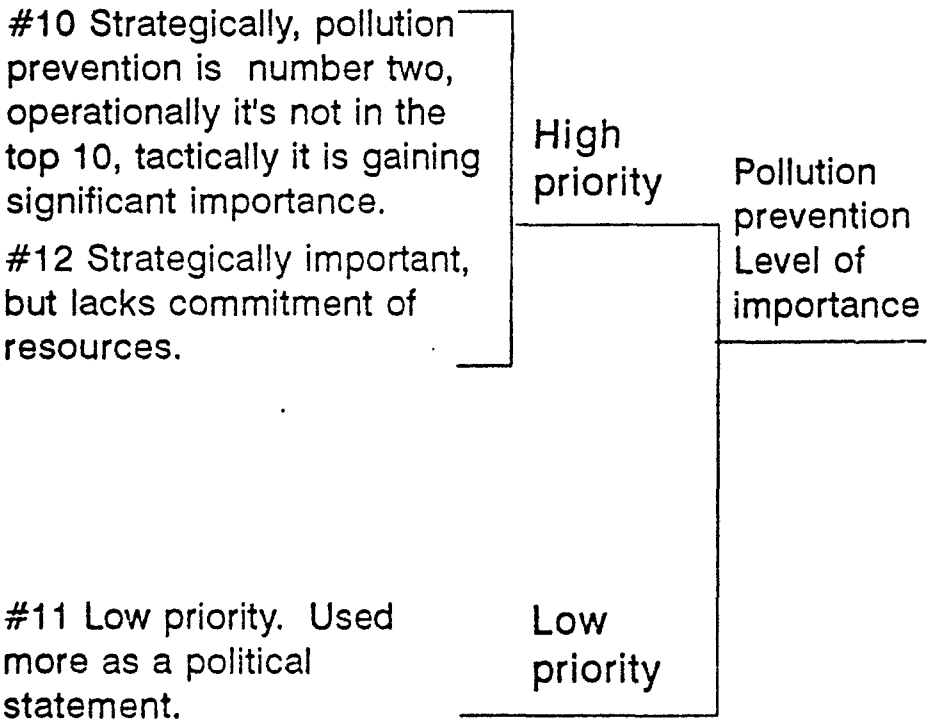


Appendix C: Dendogram Analysis
Awareness Question 3-Strategic

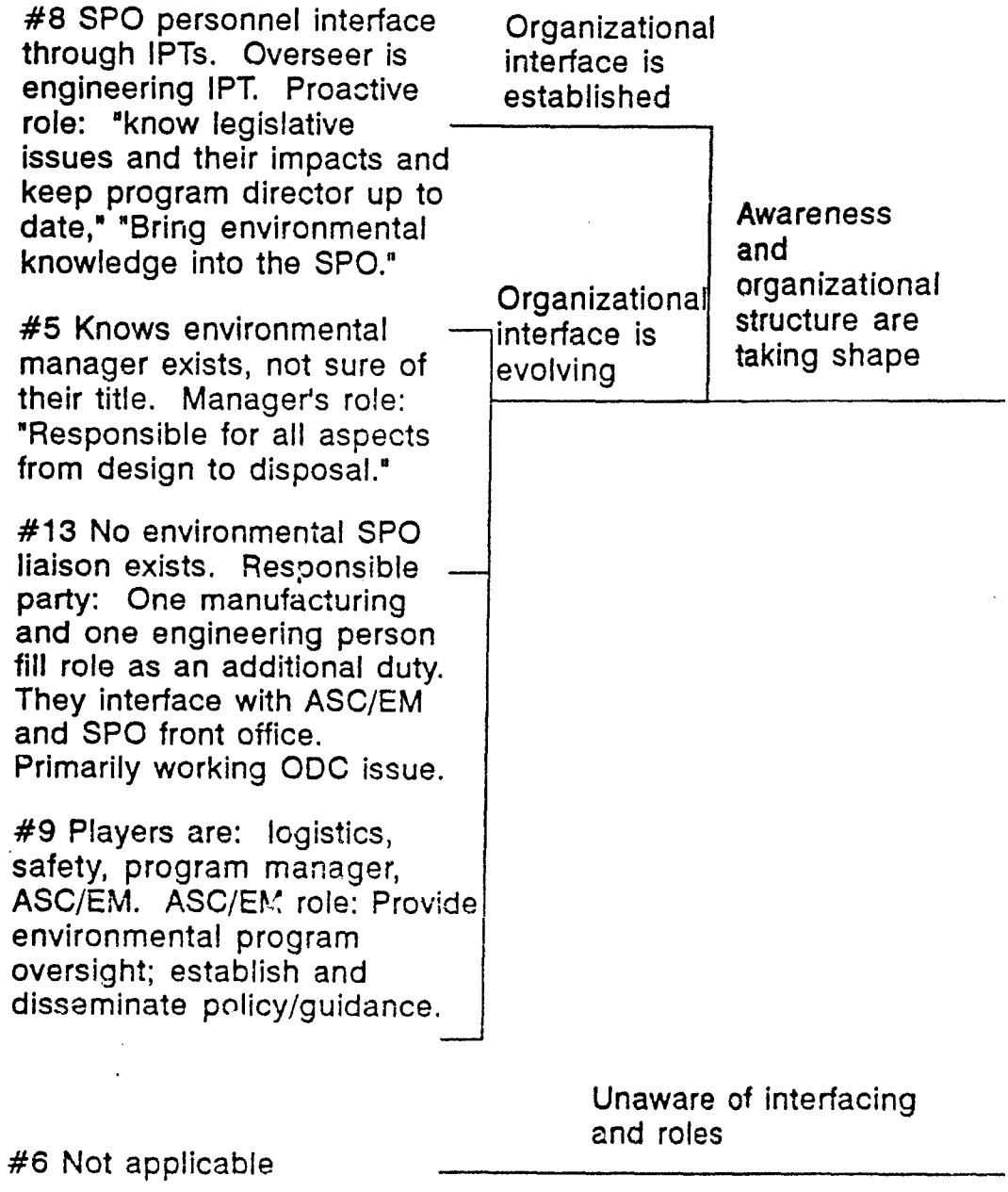


Appendix C: Dendogram Analysis

Awareness Question 4-Strategic



Appendix C: Dendogram Analysis
Awareness Question 2-Contracting



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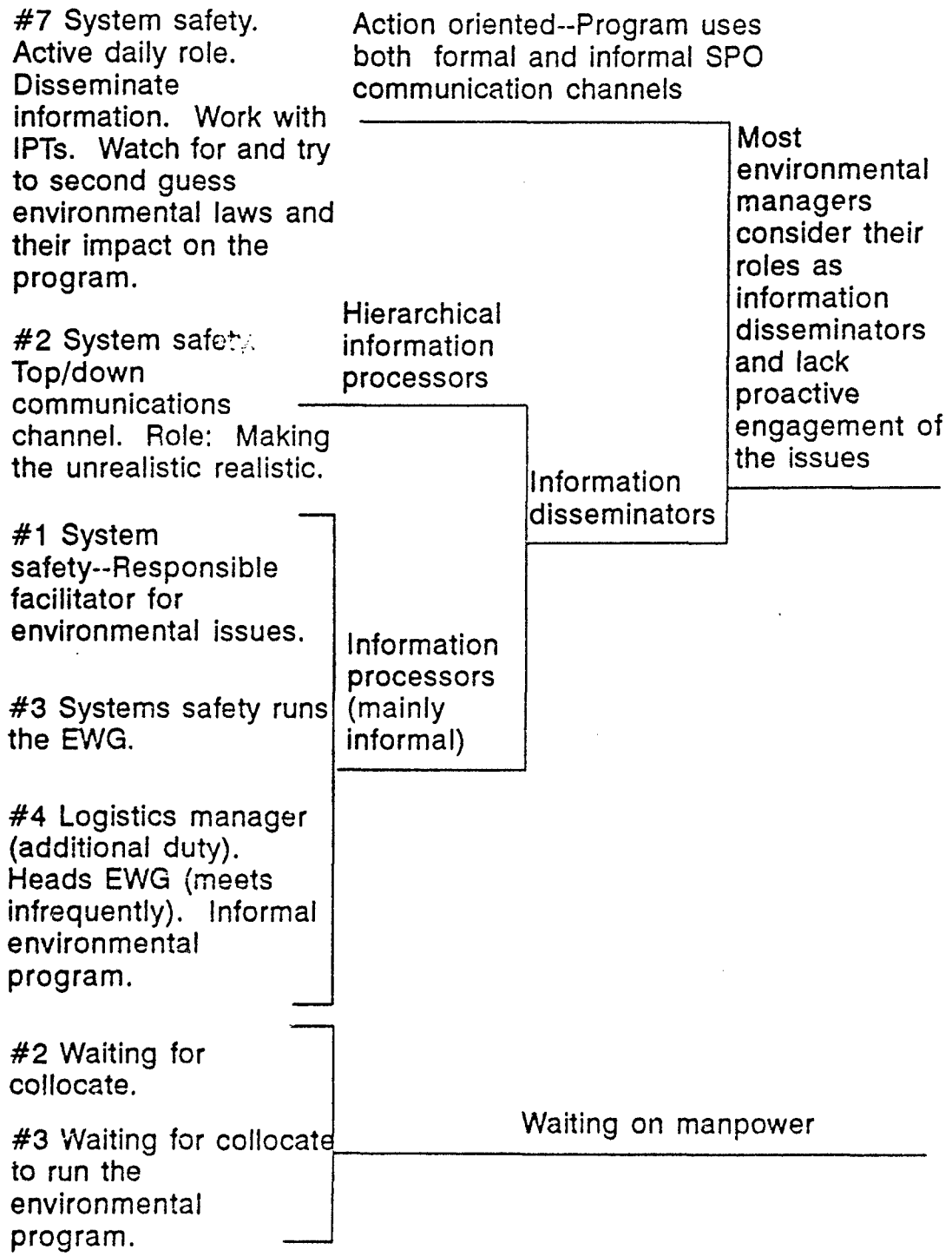
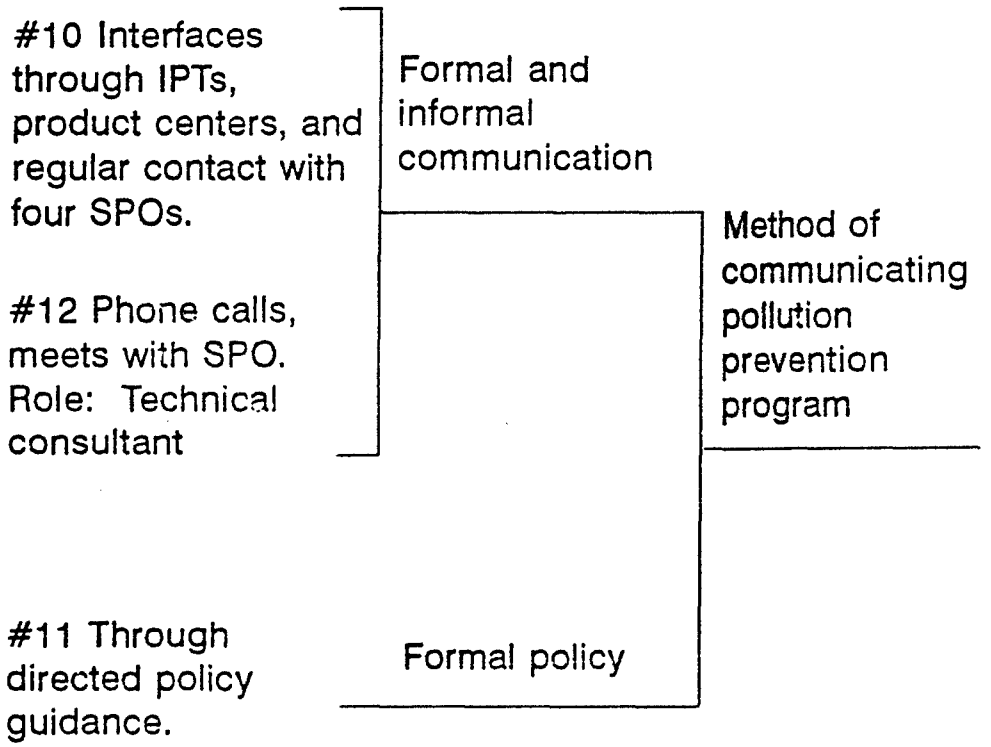
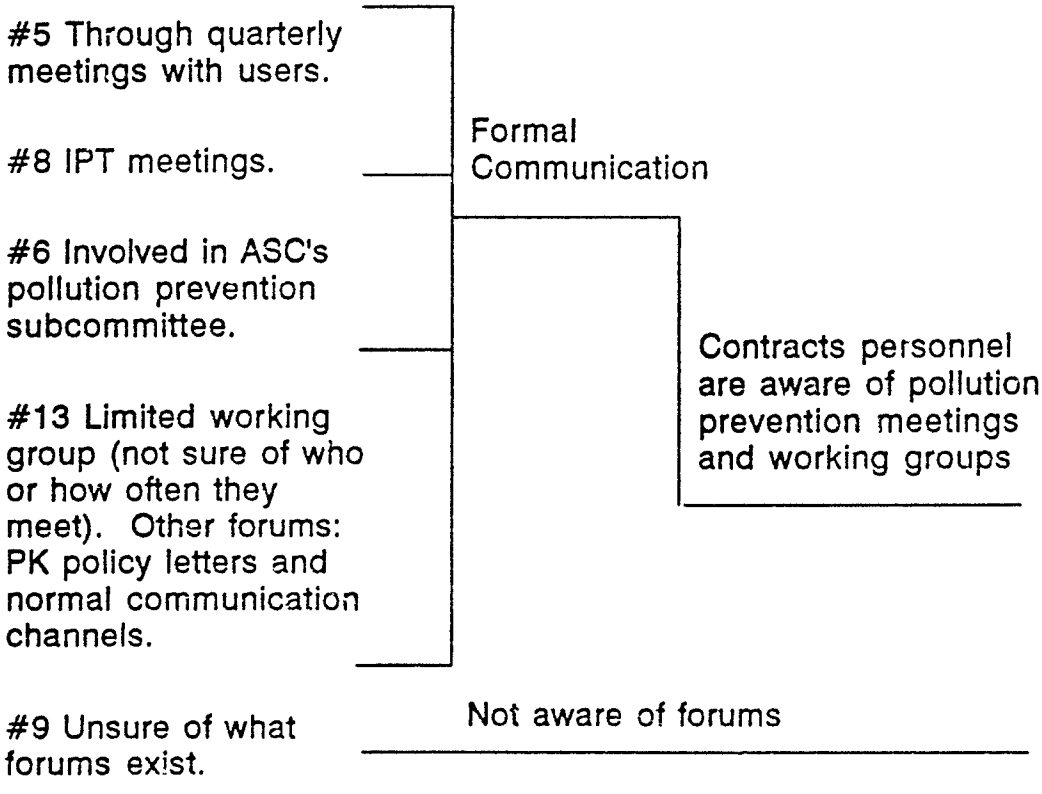
Awareness Question 2-Environmental



Appendix C: Dendogram Analysis
Awareness Question 6-Strategic



Appendix C: Dendogram Analysis
Awareness Question 3-Contracting



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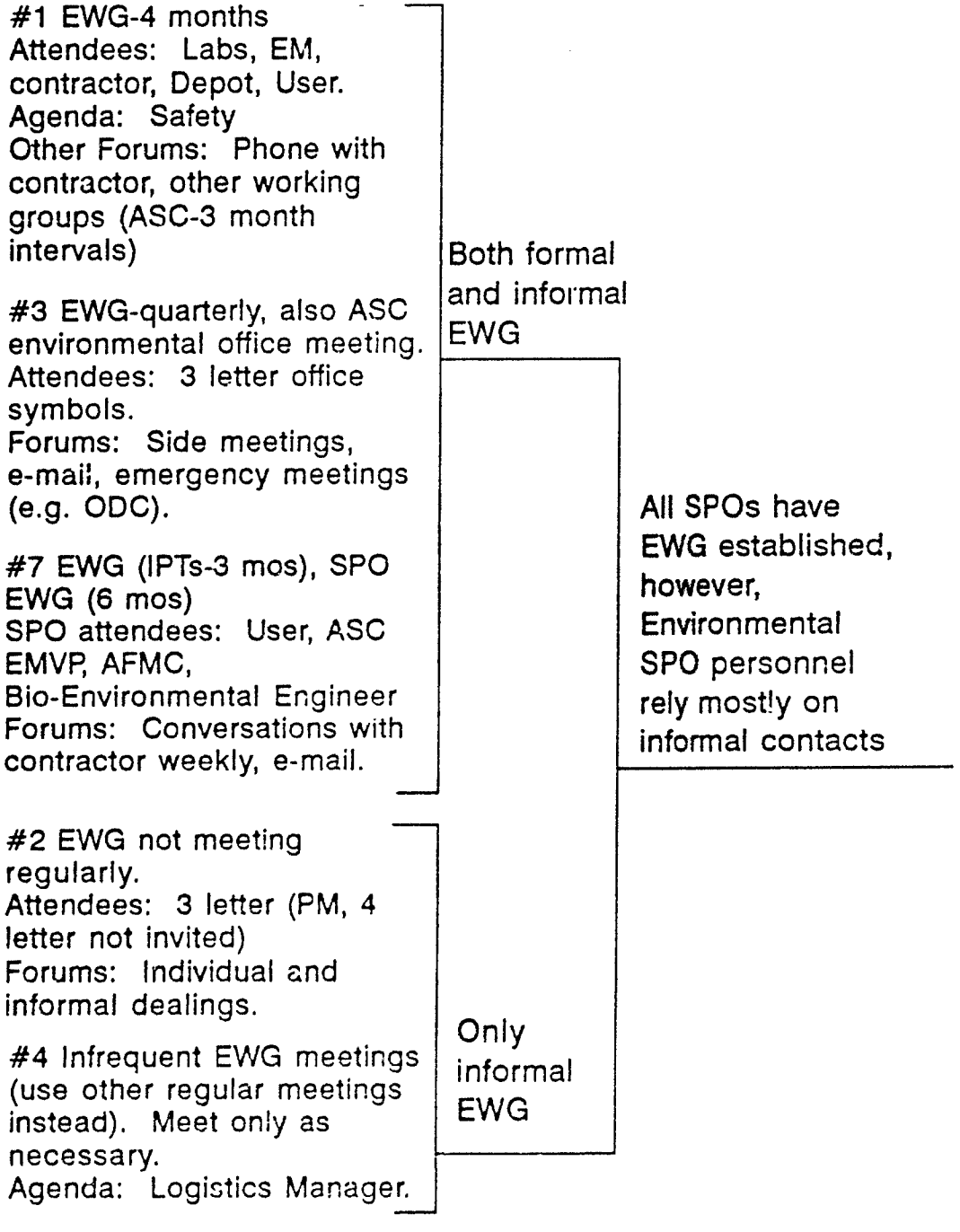
Awareness Question 3-Environmental



Appendix C: Dendogram Analysis
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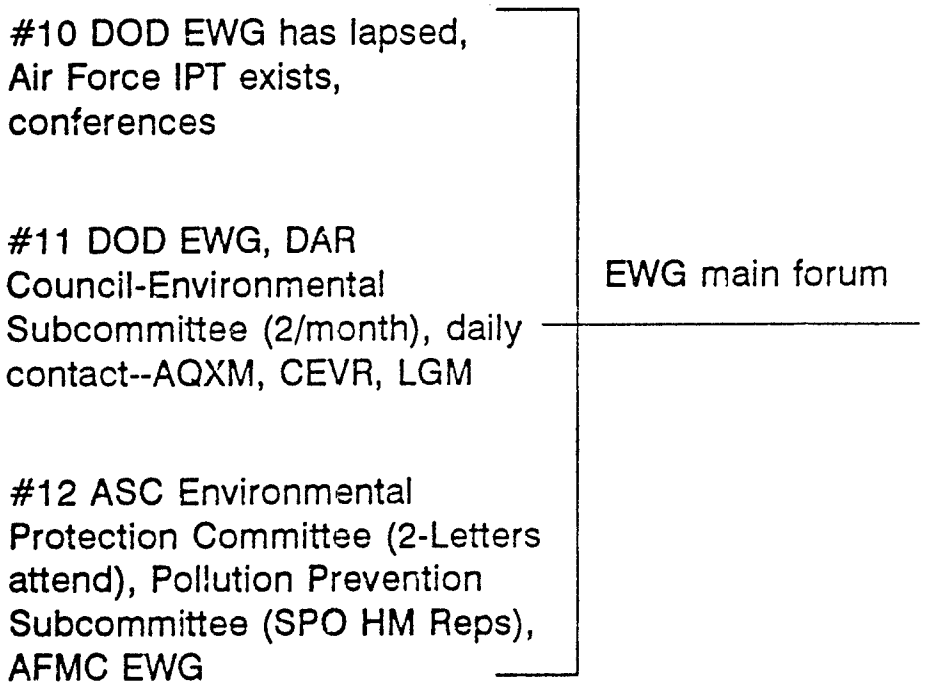
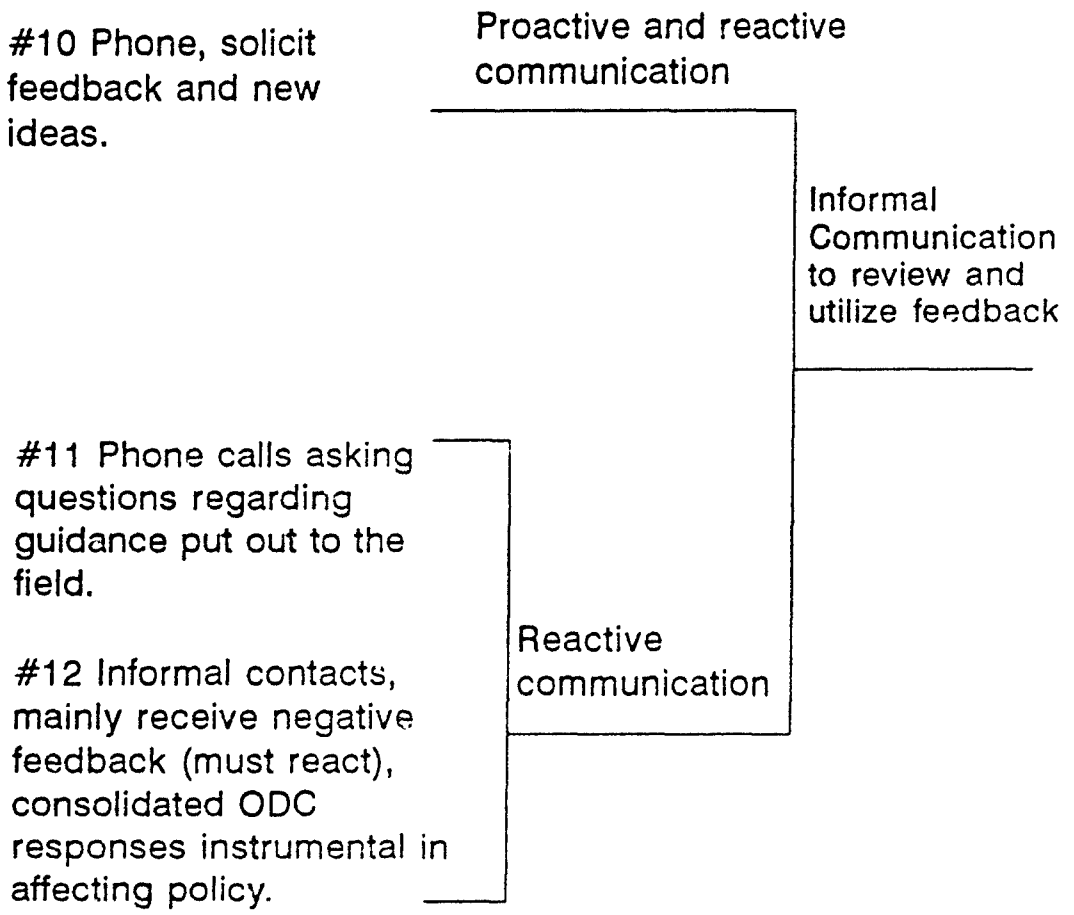
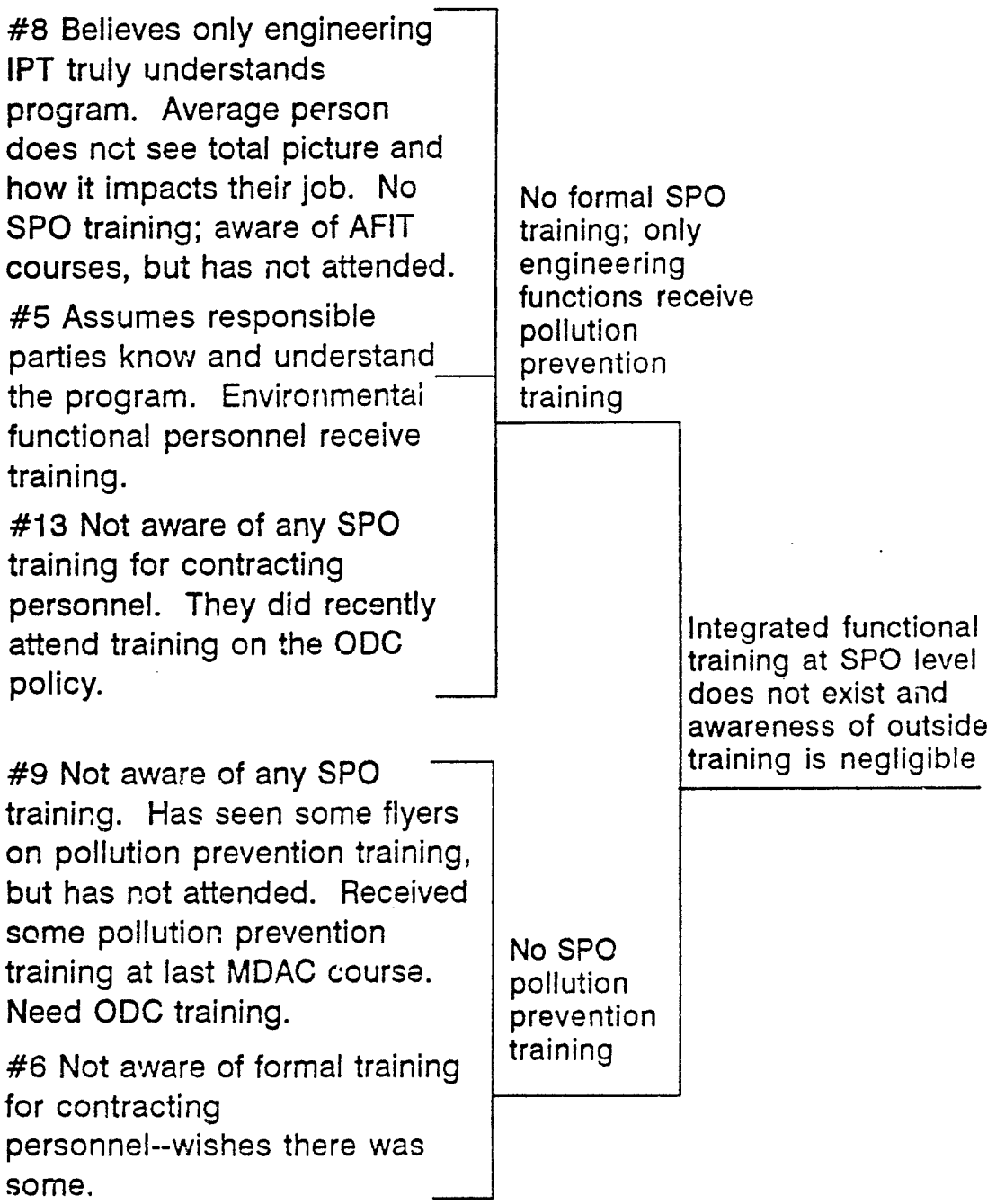


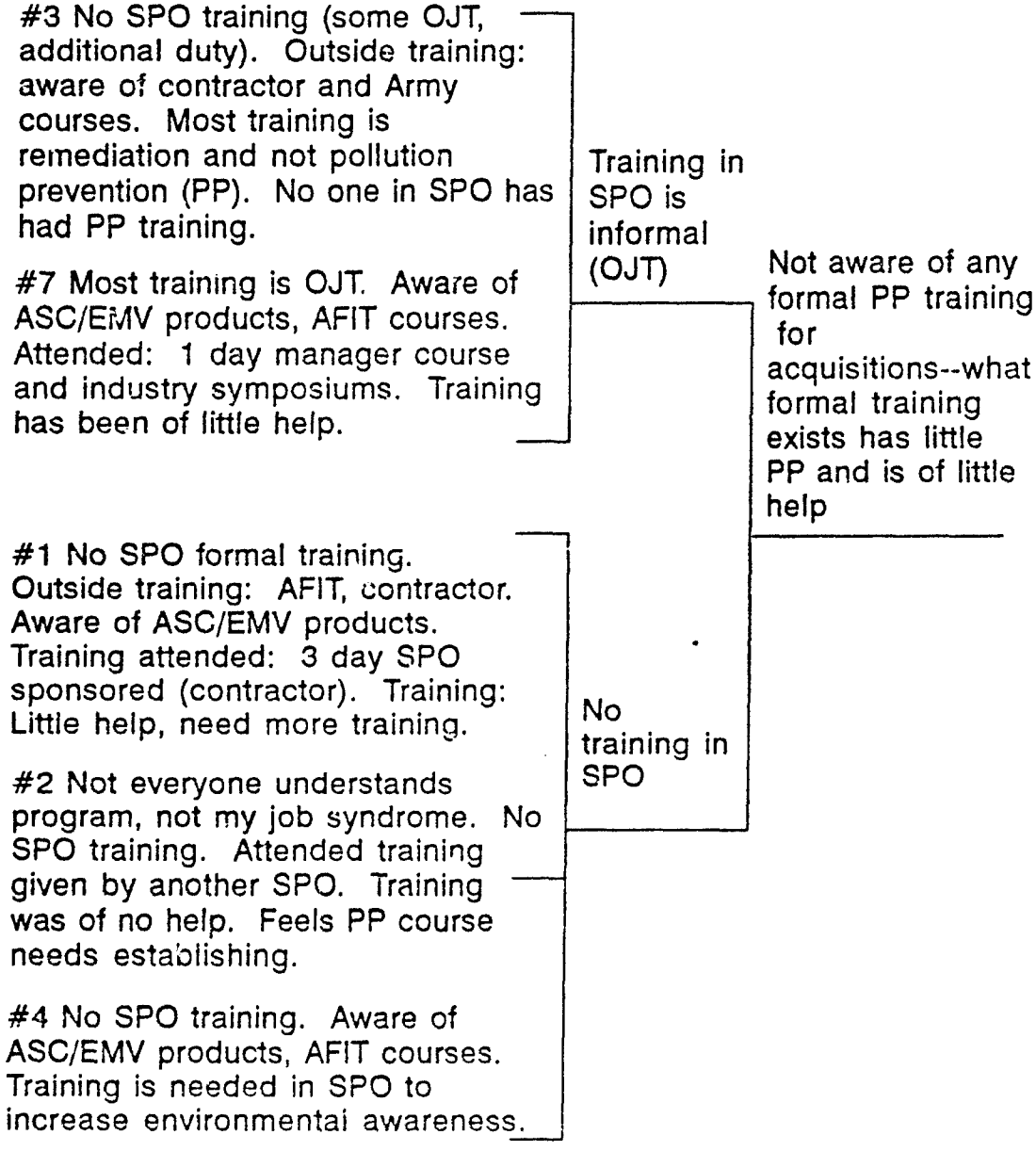
Appendix C: Dendogram Analysis
Awareness Question 8&9-Strategic



Appendix C: Dendogram Analysis
Awareness Question 4-Contracting

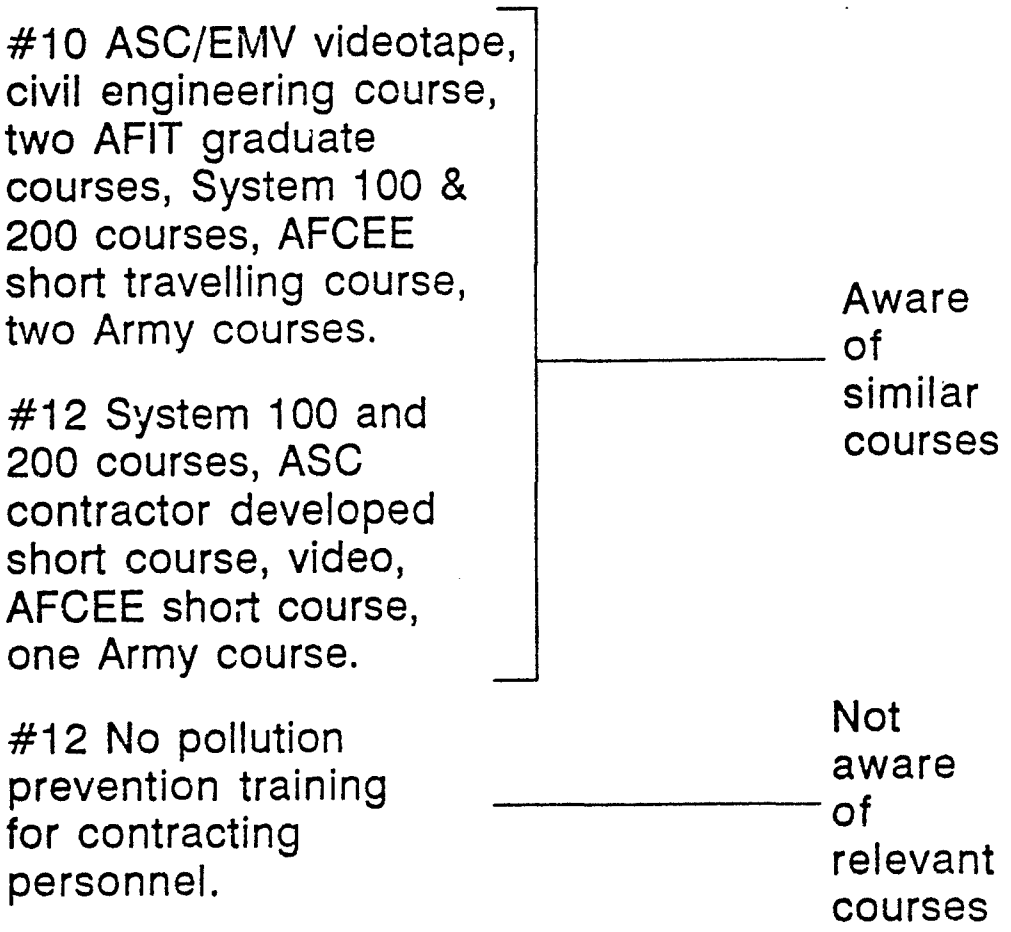


Appendix C: Dendogram Analysis
Awareness Question 4-Environmental

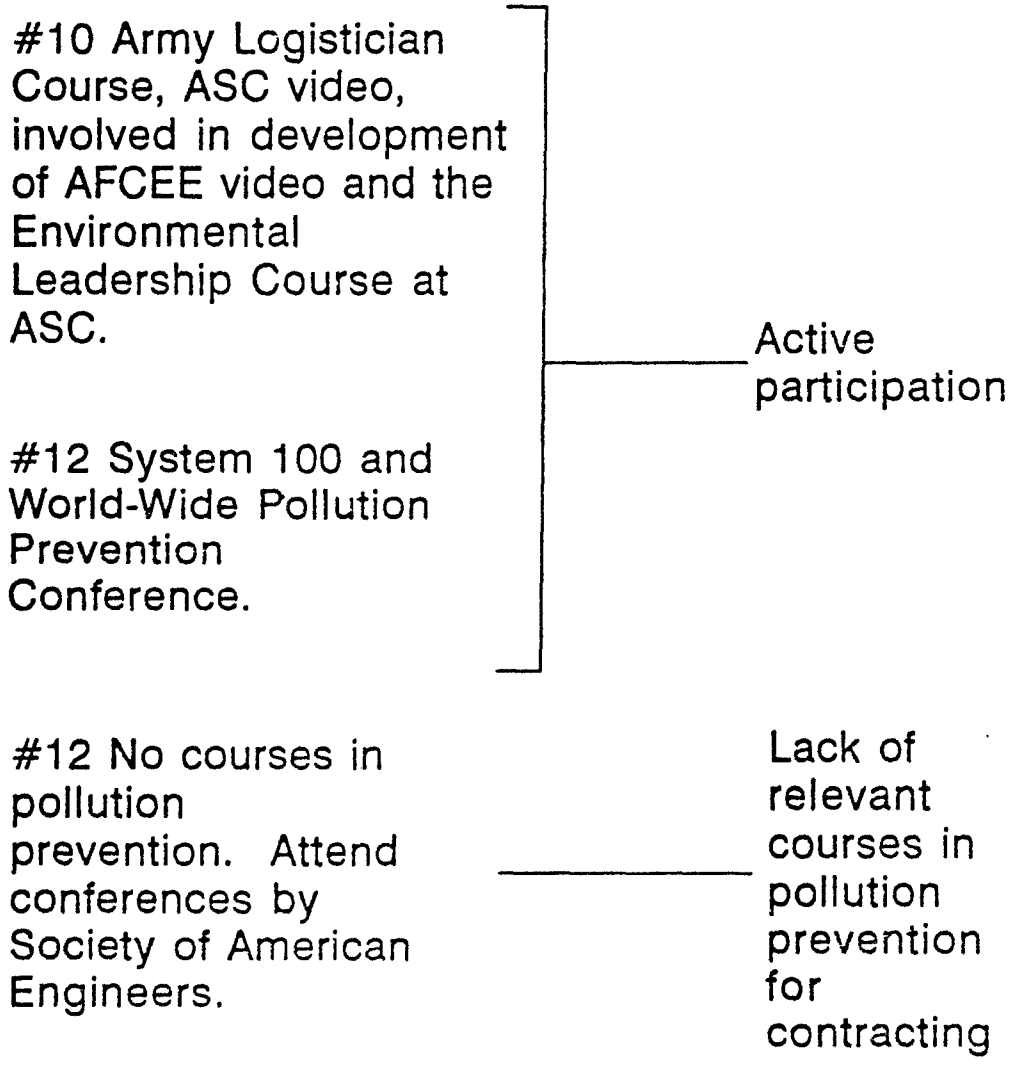


Appendix C: Dendogram Analysis

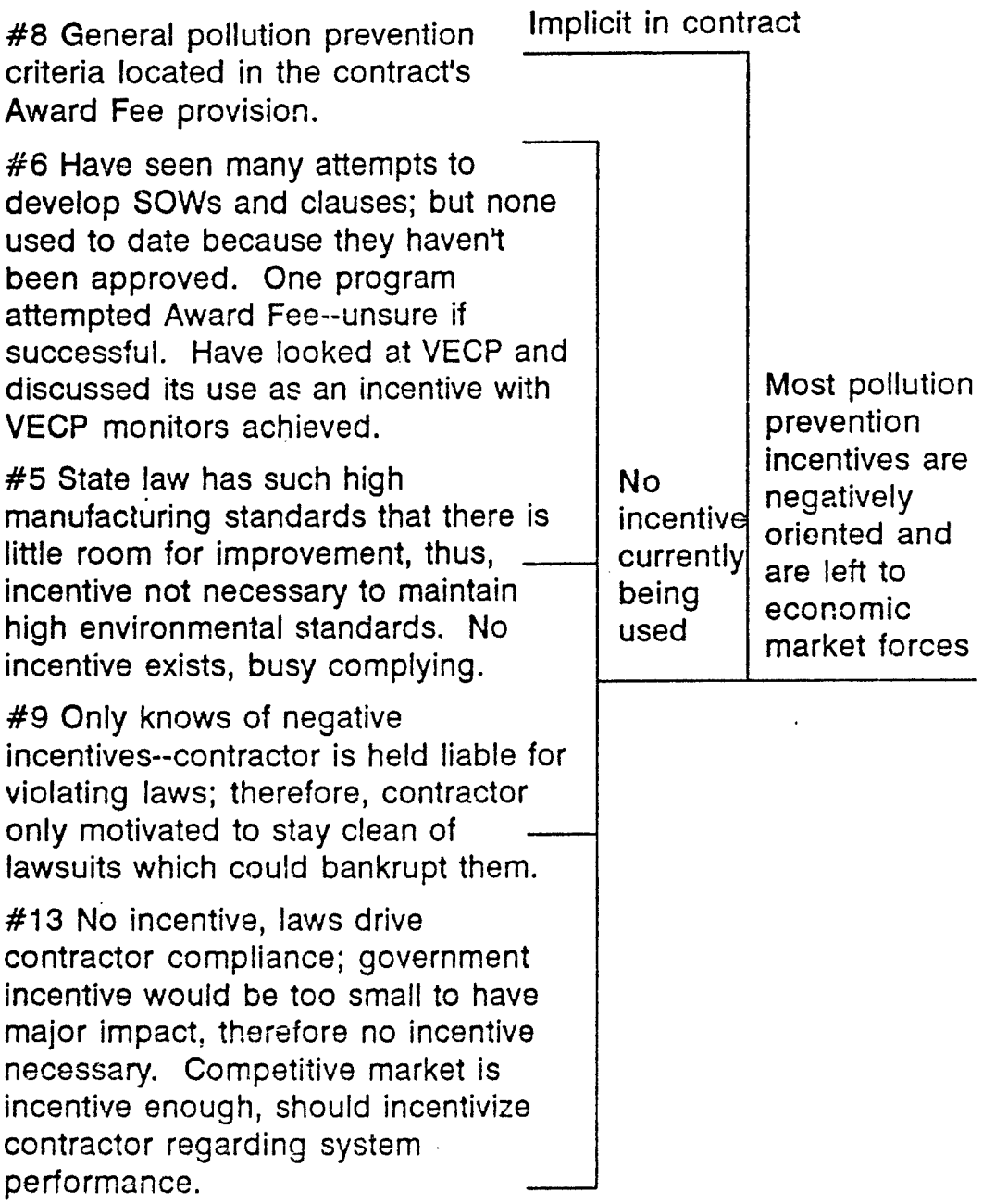
Awareness Question 10-Strategic



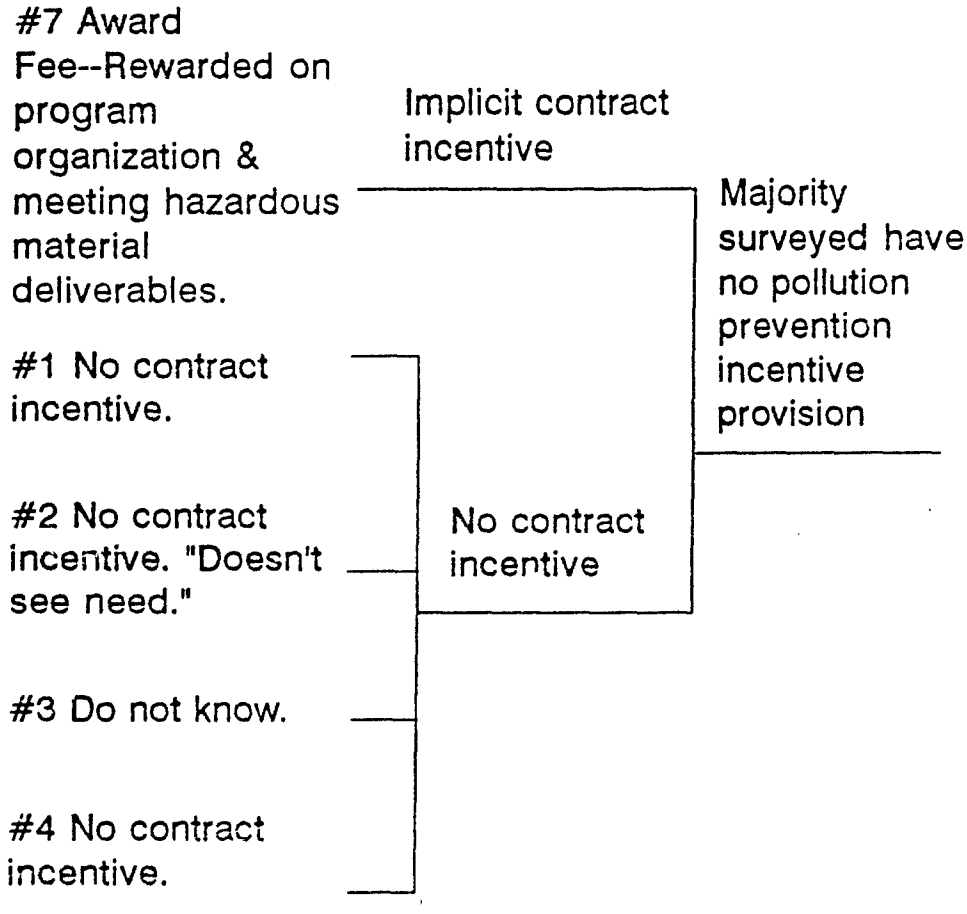
Appendix C: Dendogram Analysis
Awareness Question 11-Strategic



Appendix C: Dendogram Analysis
Incentives Question 1-Contracting



Appendix C: Dendogram Analysis
Incentive Question 1-Environmental



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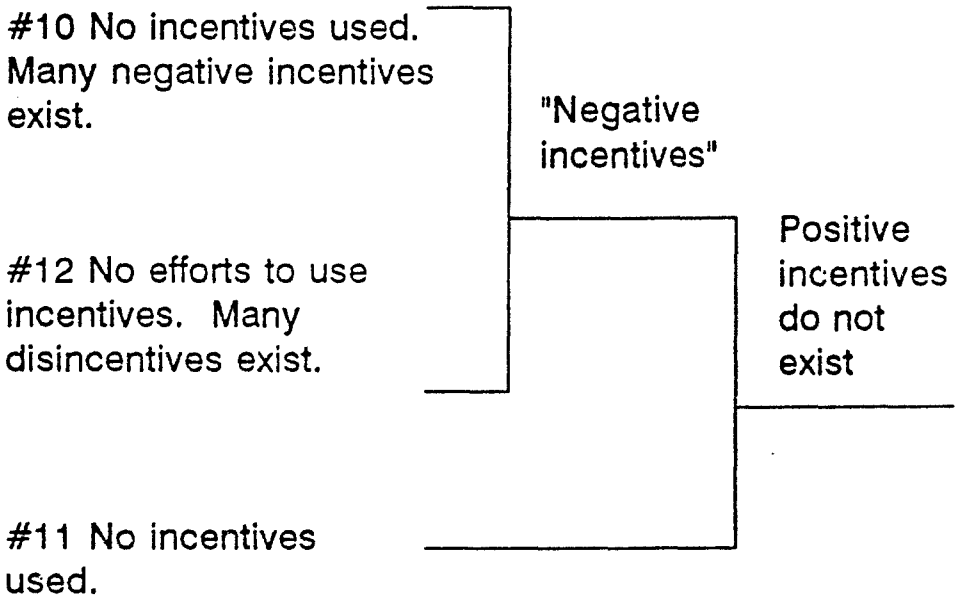
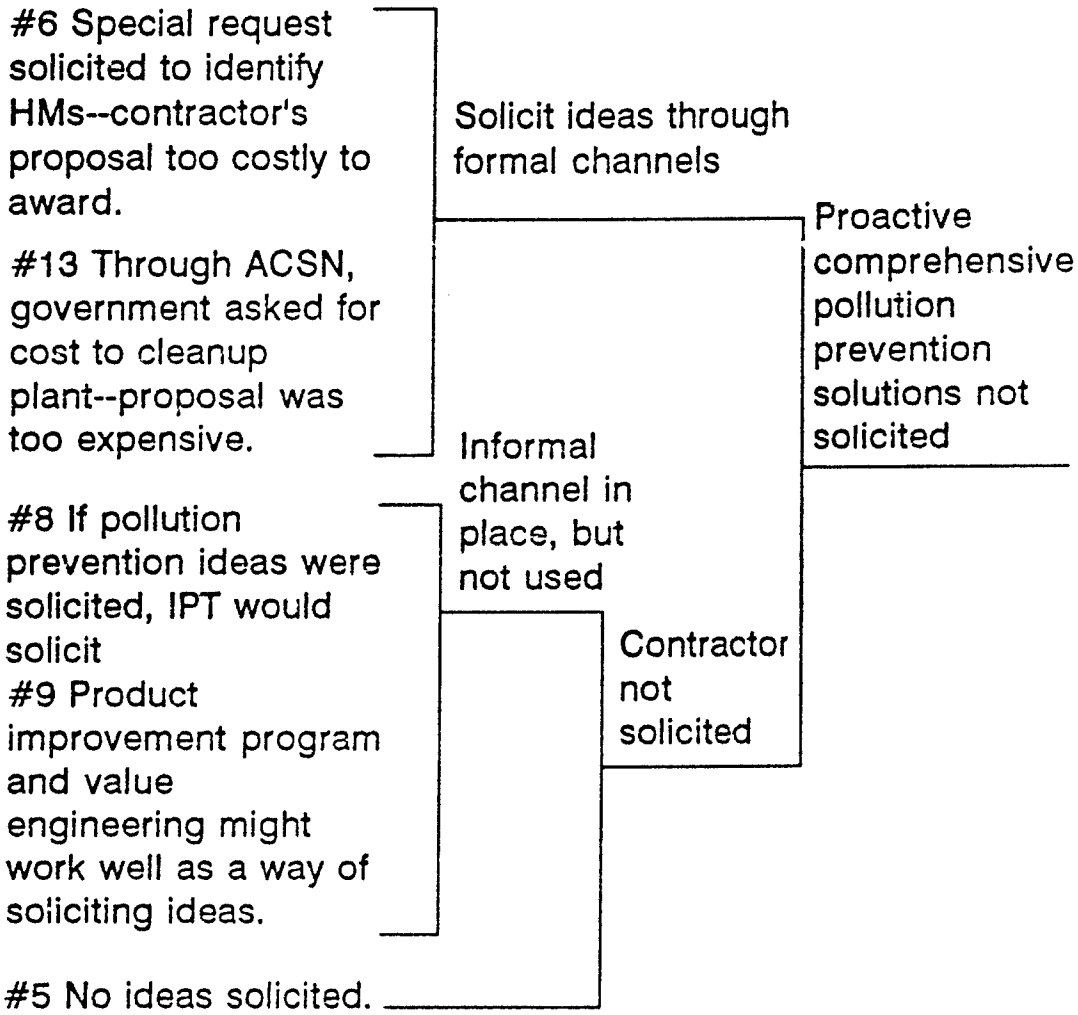
Incentives Question 1-Strategic



Appendix C: Dendogram Analysis
Incentive Question 2-Contracting



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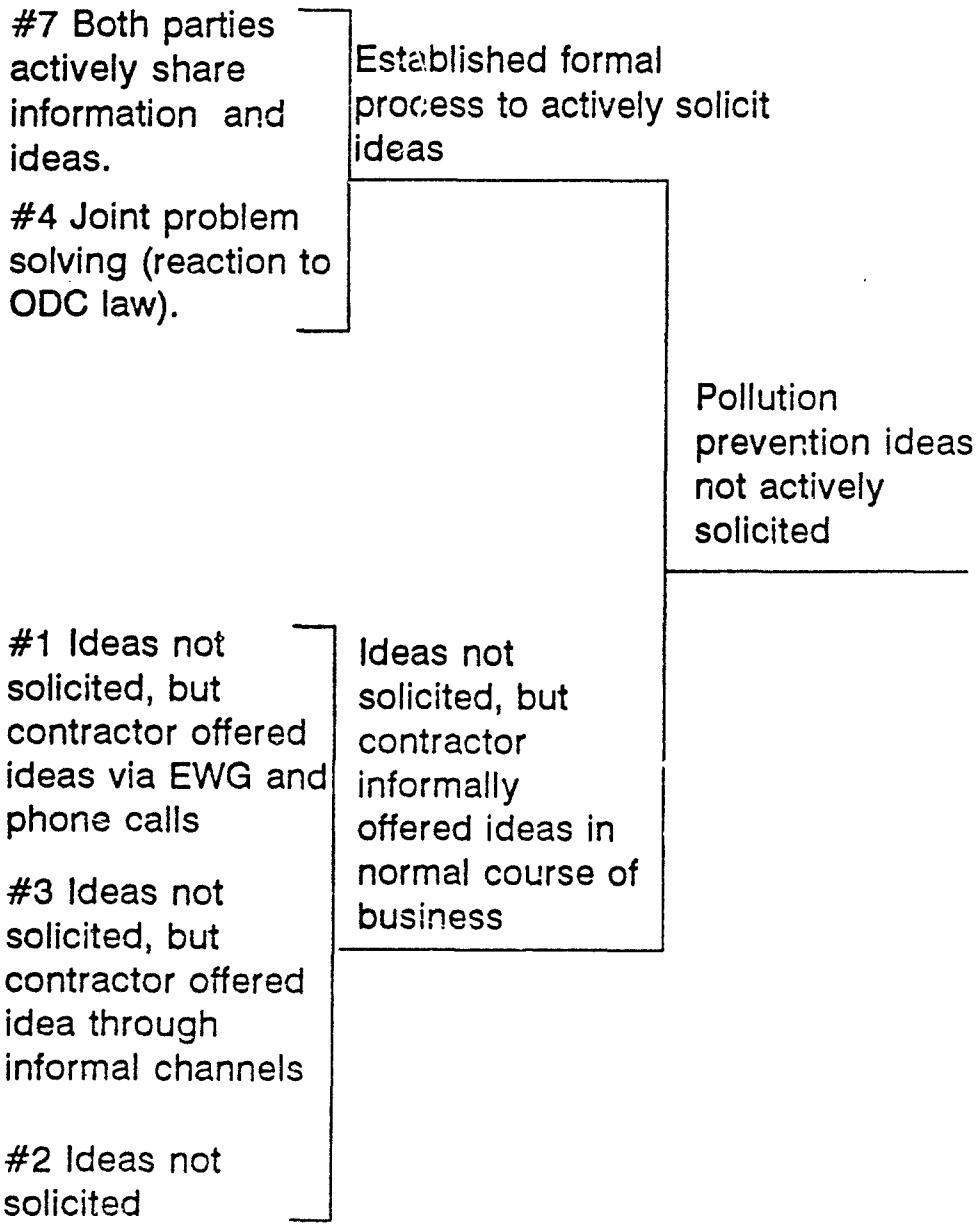
Incentives Question 2-Environmental



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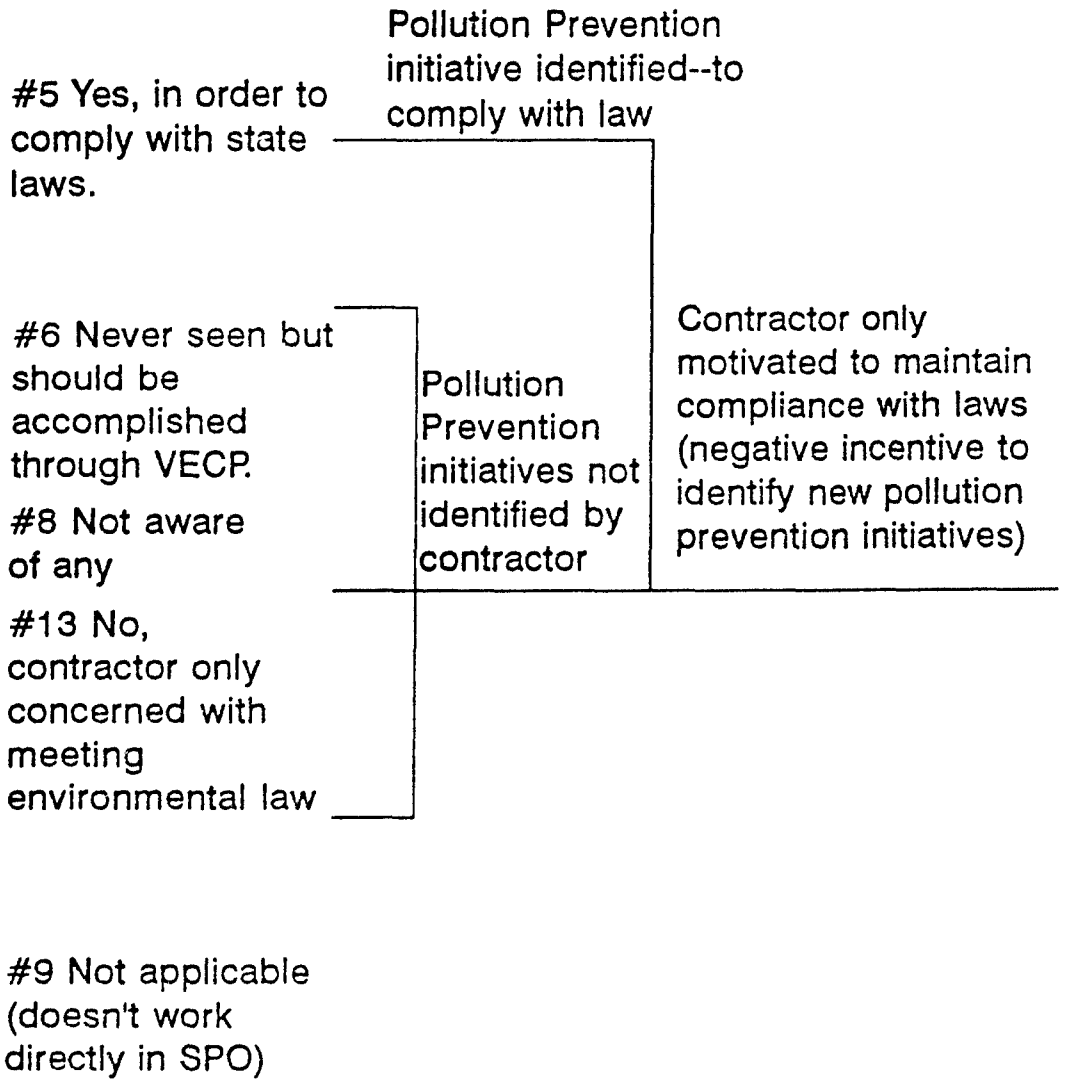
Incentives Question 3-Contracting



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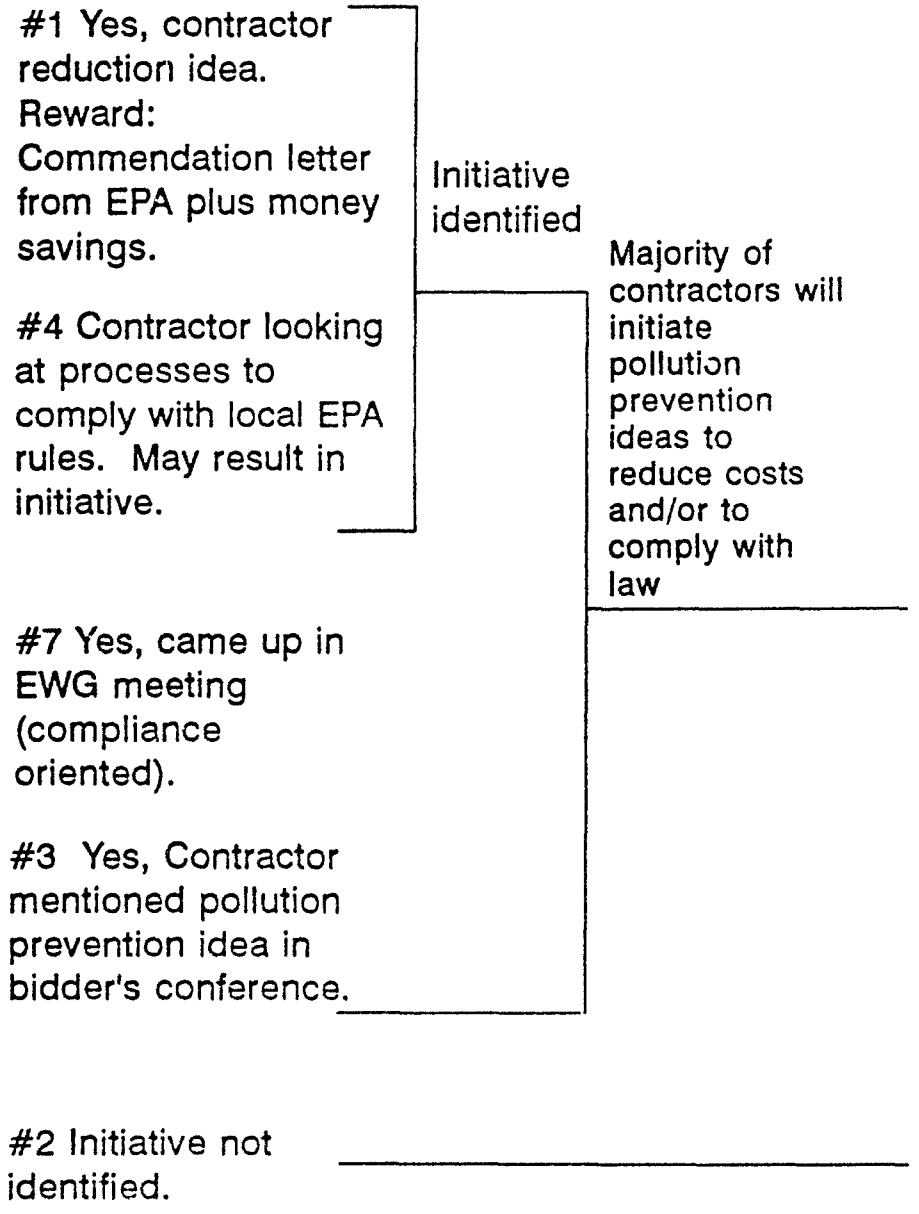
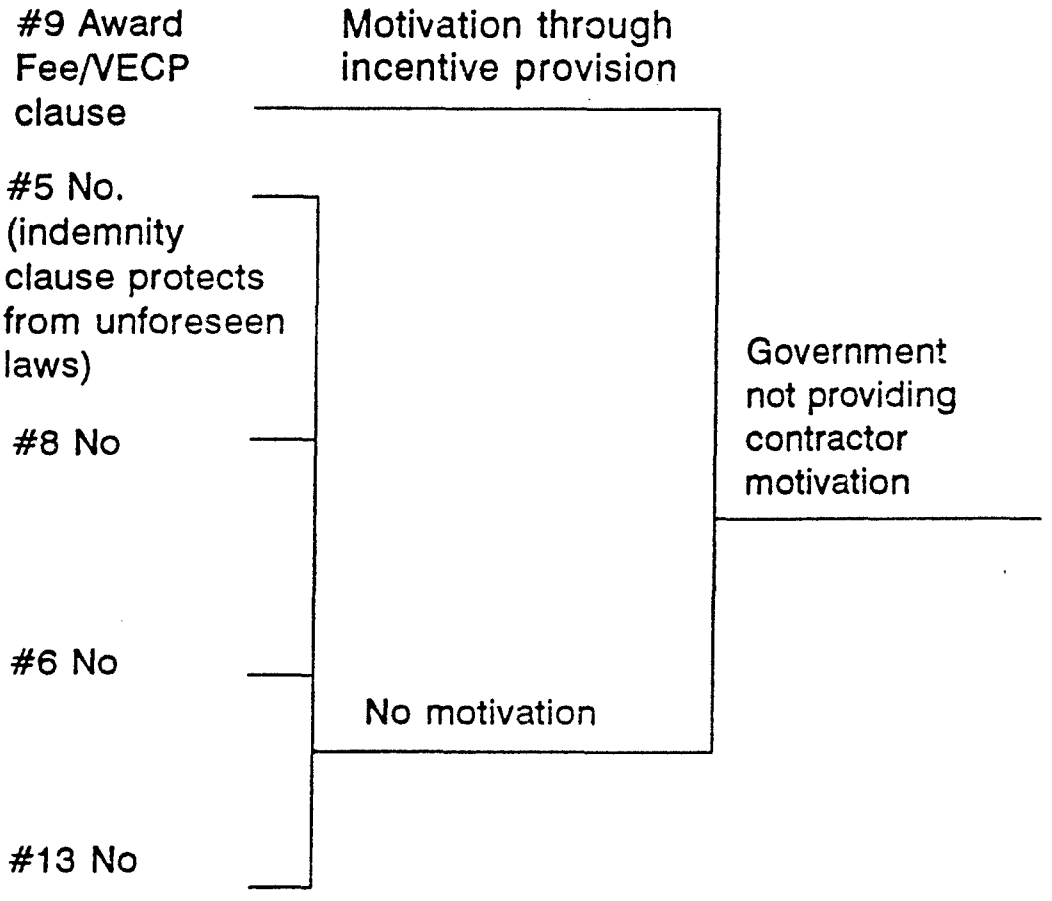
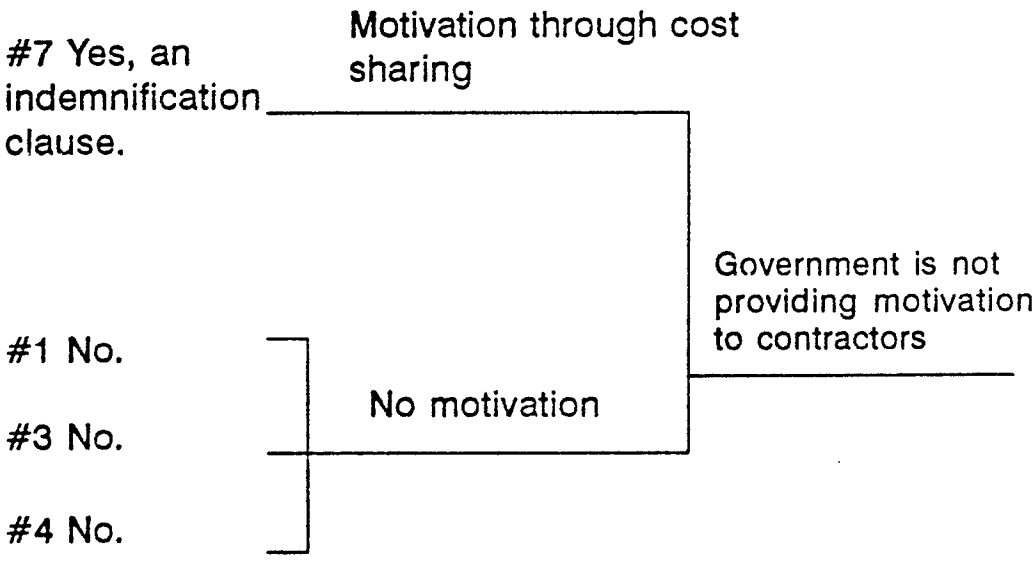
Incentives Question 3-Environmental



Appendix C: Dendogram Analysis
Incentives Question 5-Contracting



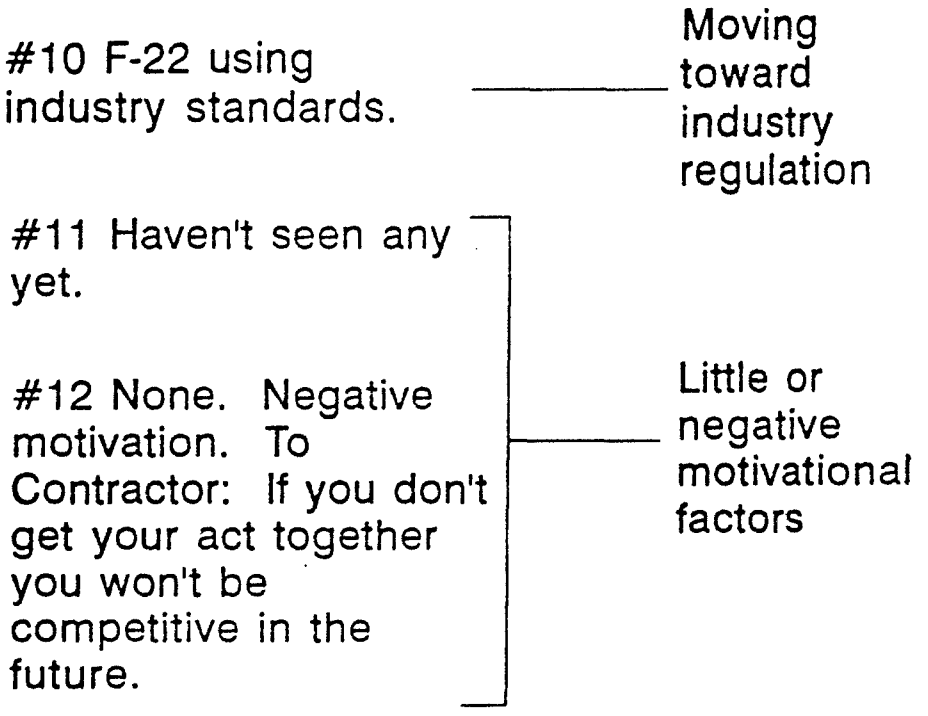
Appendix C: Dendogram Analysis
Incentive Question 5-Environmental



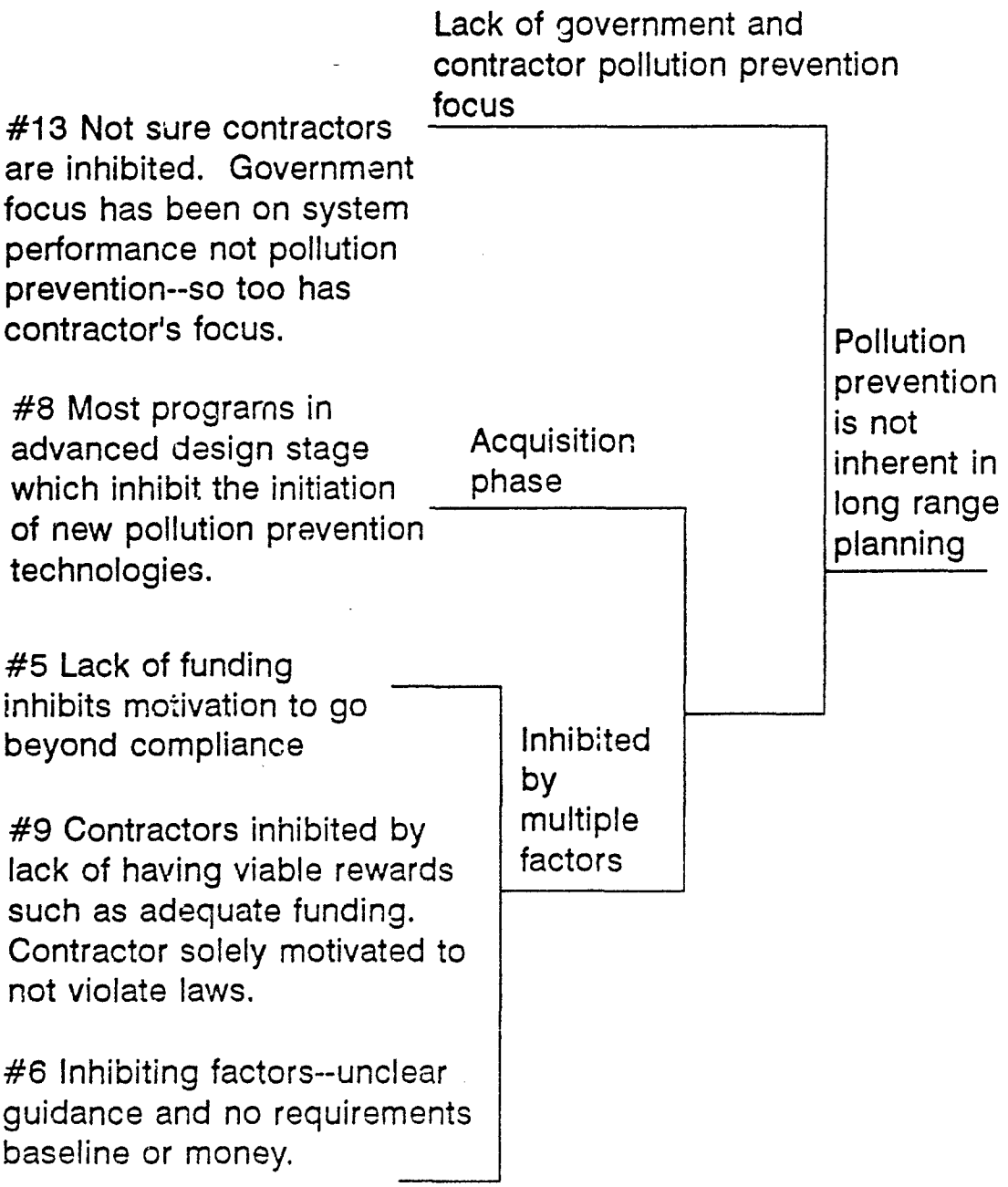
#2 No answer.

Appendix C: Dendogram Analysis

Incentive Question 3-Strategic

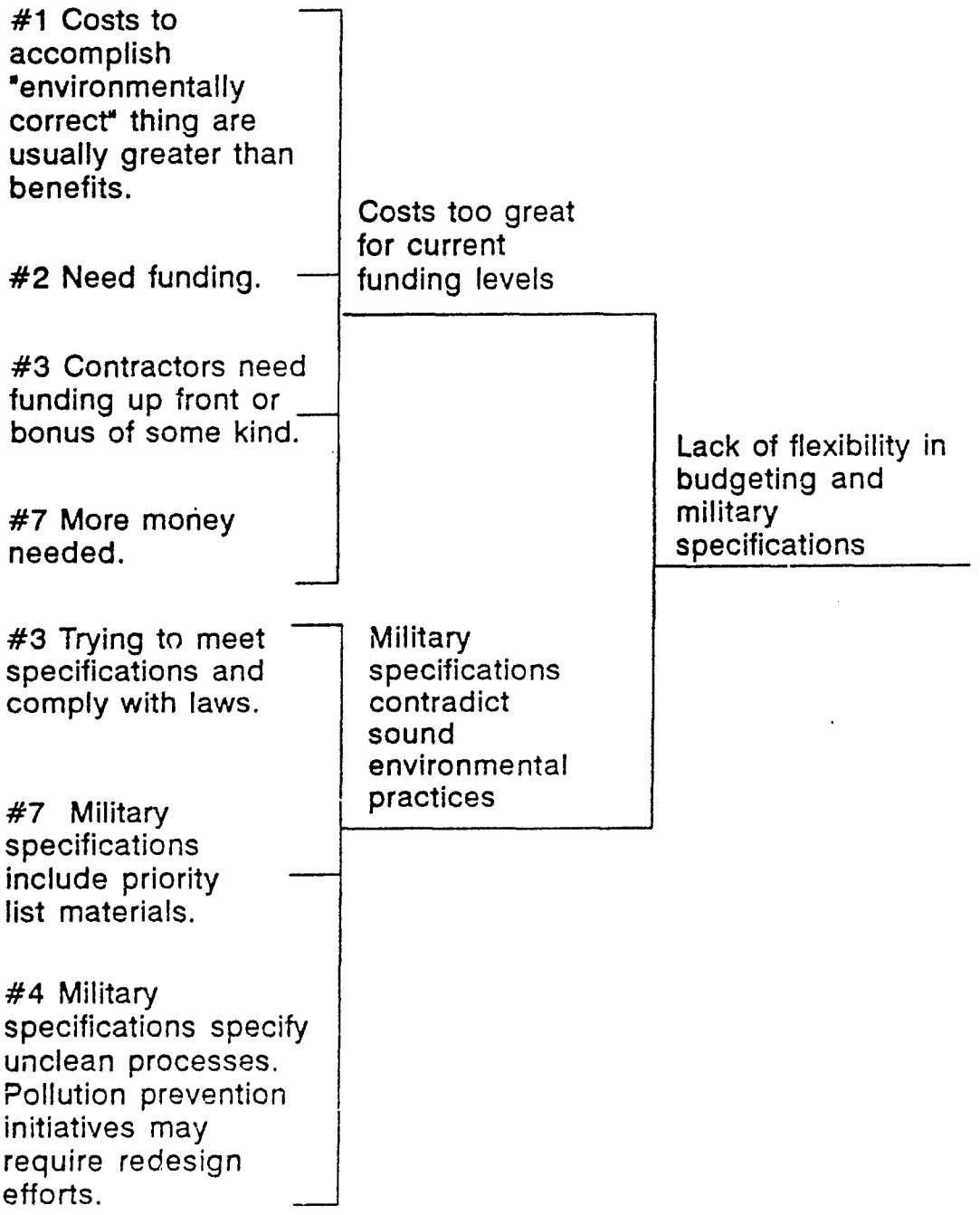


Appendix C: Dendogram Analysis
Incentive Question 4-Contracting

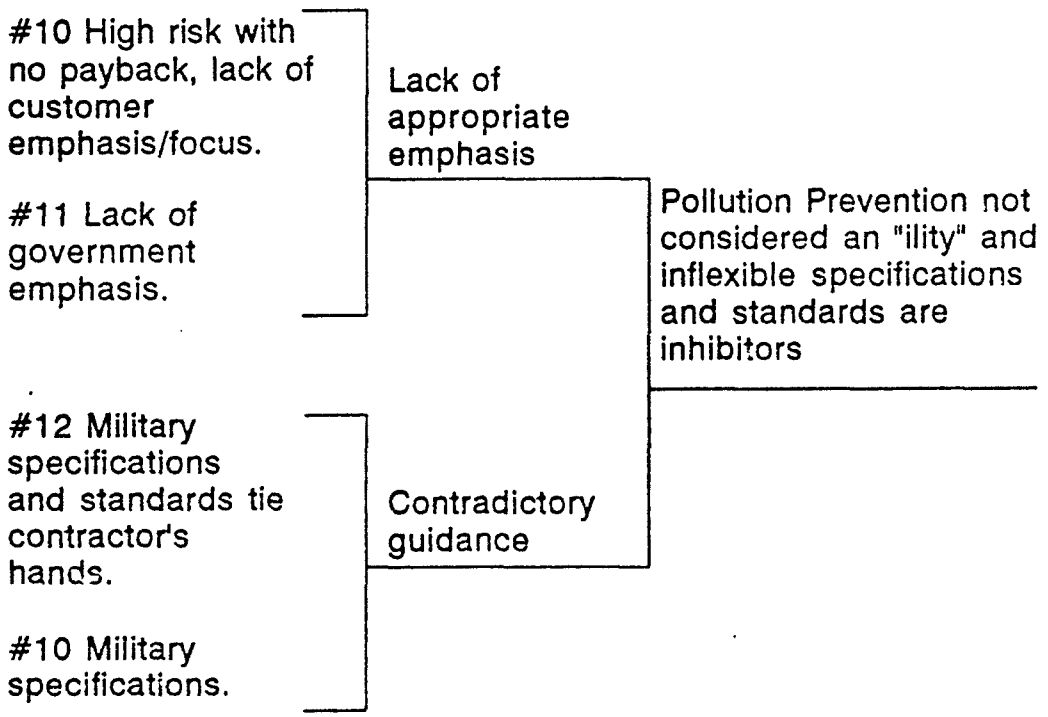


Appendix C: Dendogram Analysis

Incentives Question 4-Environmental

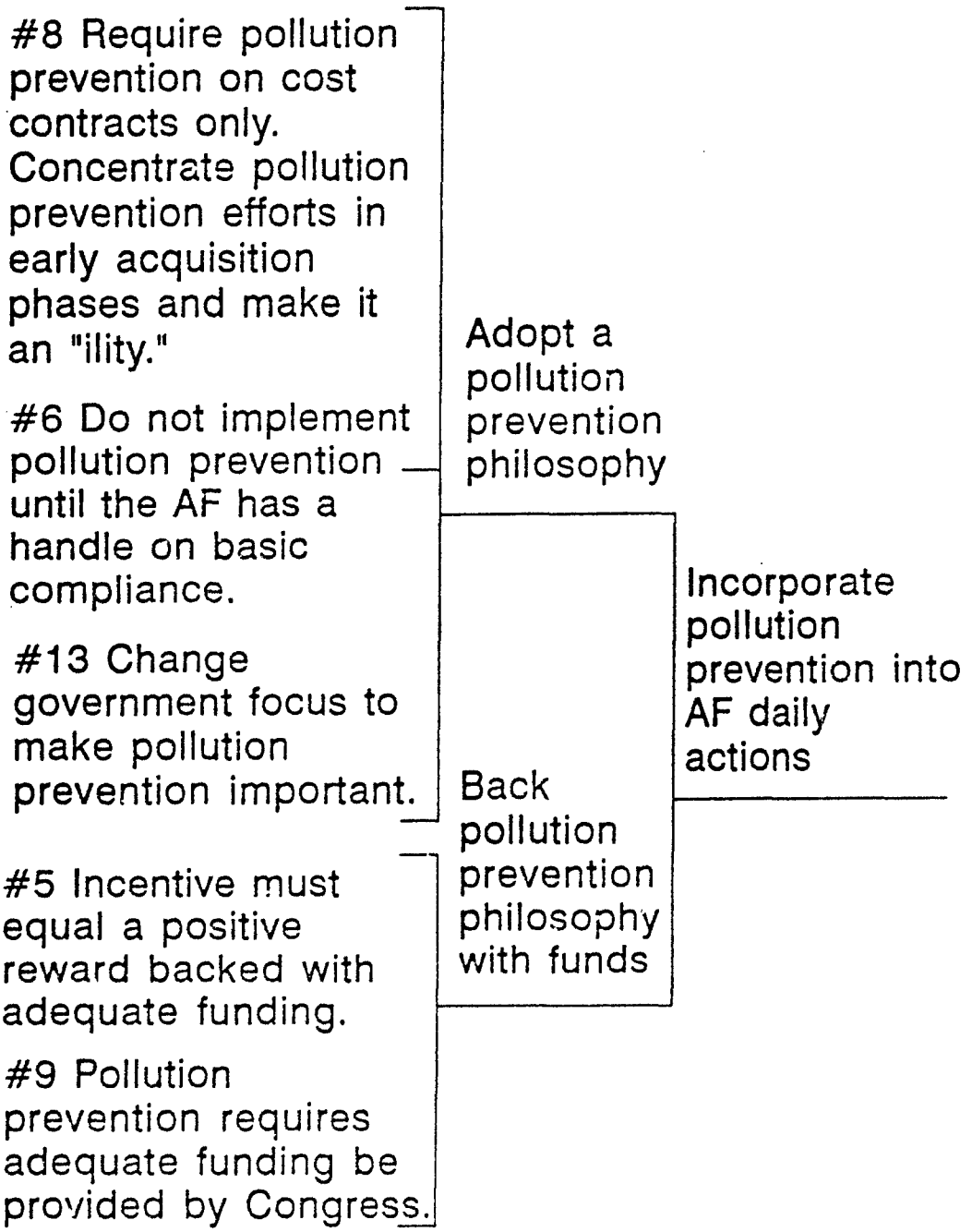


Appendix C: Dendogram Analysis
Incentive Question 2-Strategic

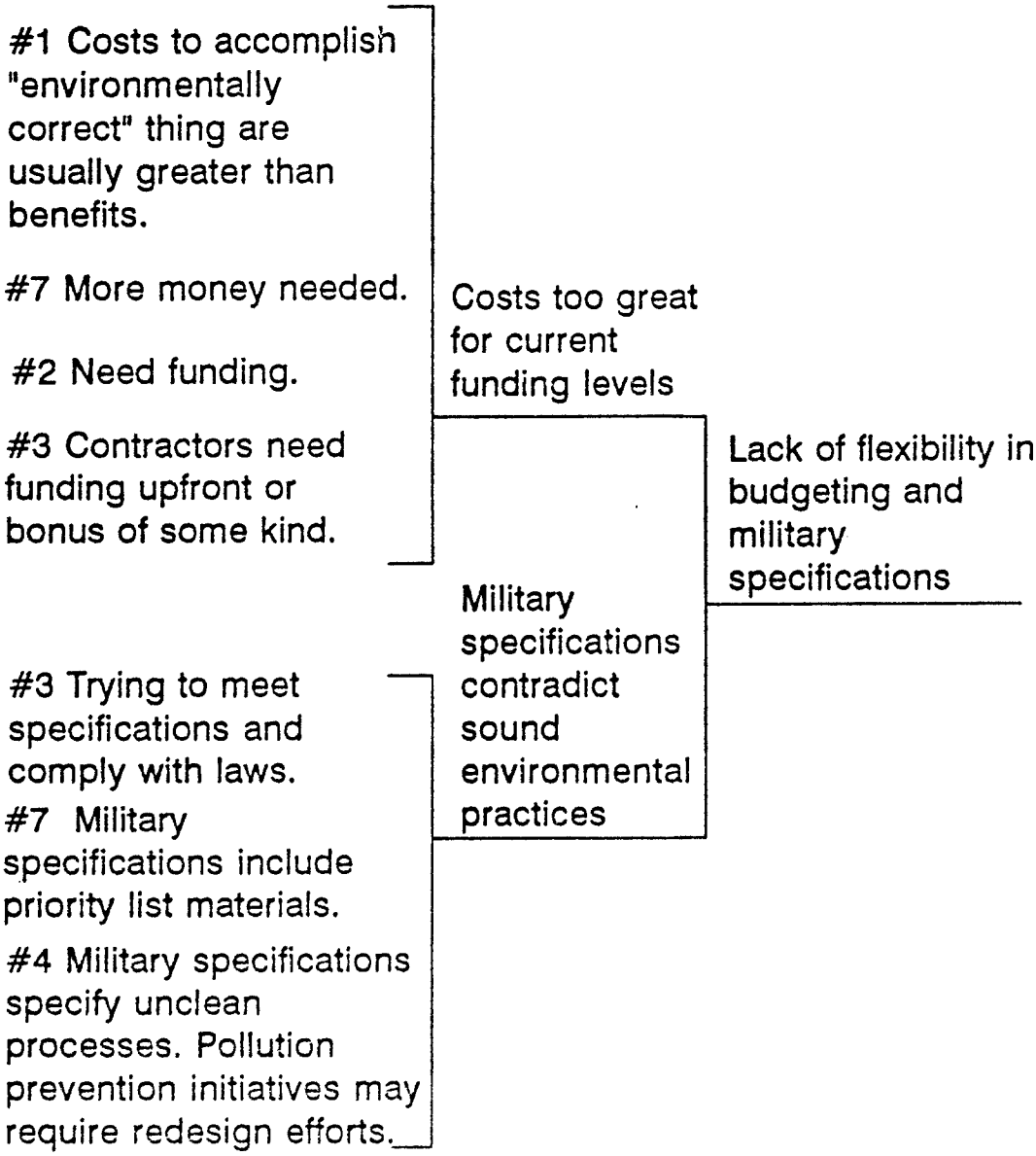


Appendix C: Dendogram Analysis

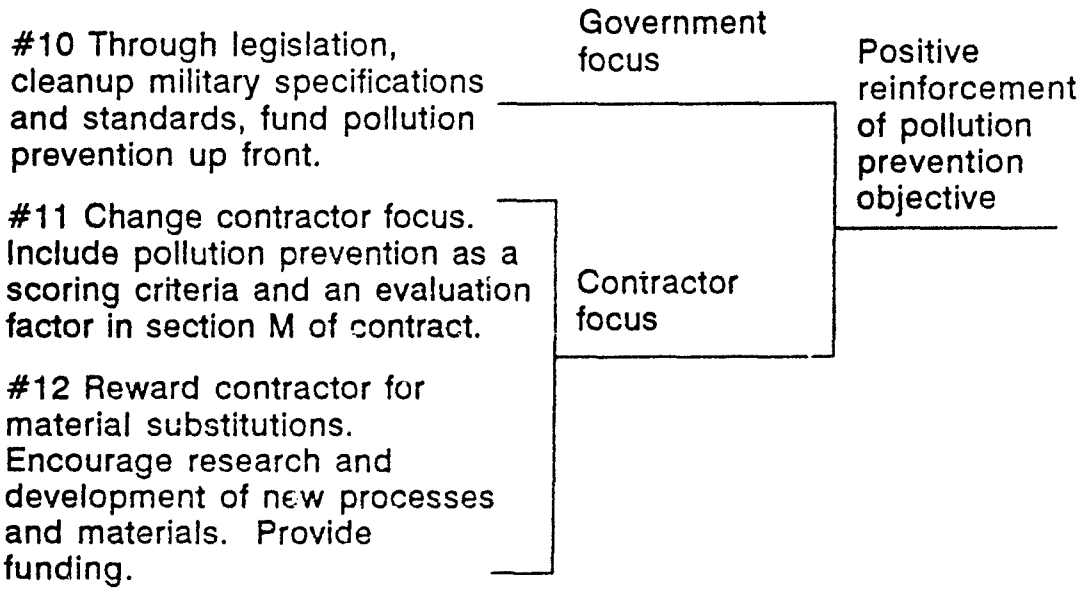
Incentives Question 4a&b - Contracting



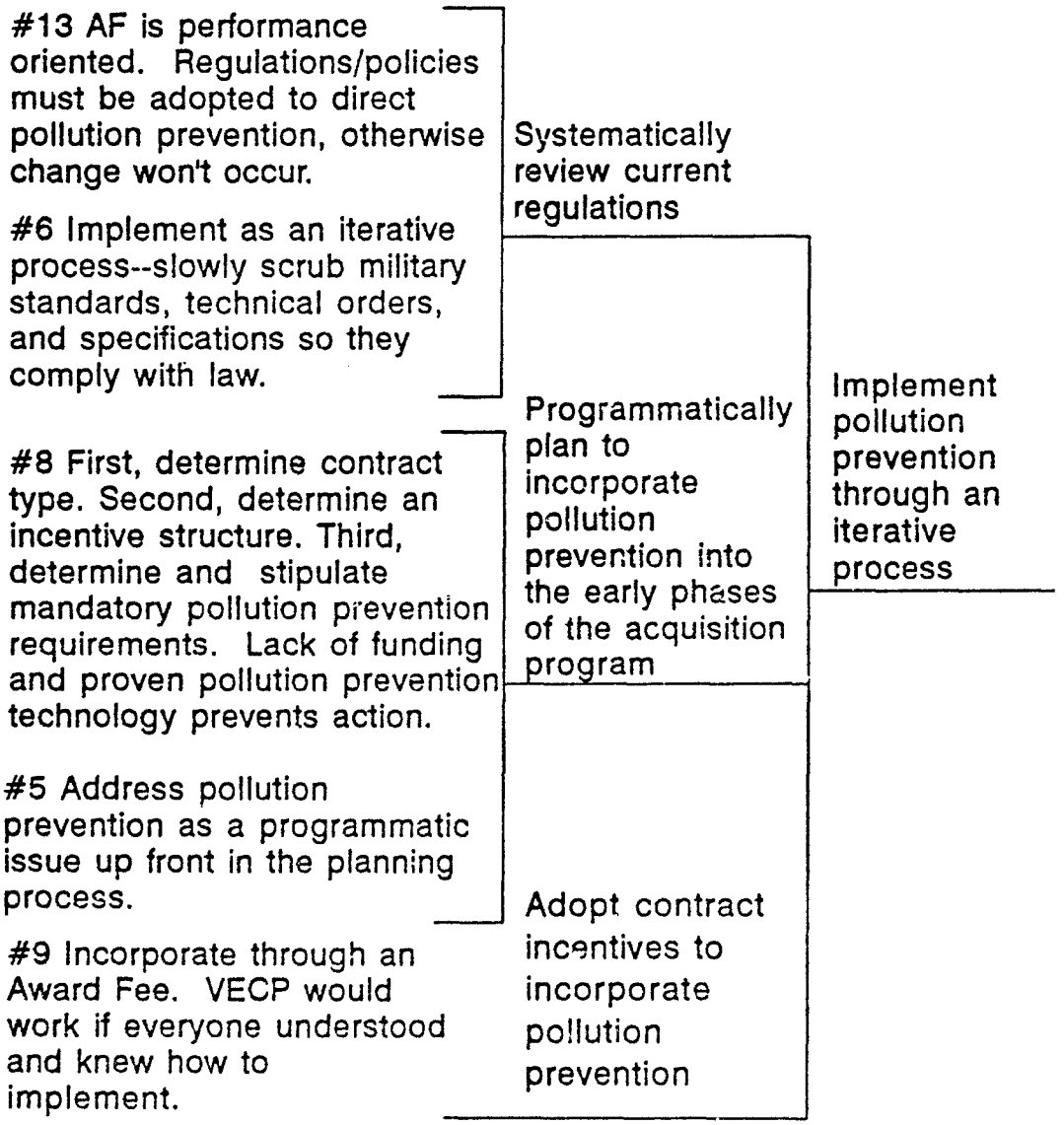
Appendix C: Dendogram Analysis
Incentives Question 4 a&b-Environmental



Appendix C: Dendogram Analysis
Incentives Question 2 a&b-Strategic



Appendix C: Dendogram Analysis
Incentives Question 6-Contracting



Appendix C: Dendogram Analysis
Incentive Question 6-Environmental

#4 Do early on in acquisition.

#3 Need unlimited budget. Look at LCC to decide what you want. Spend money up front.

#7 Consider materials in design phase. Centralized database (substitutes). Encourage technology transfer. Lack of uniform concrete guidance. Establish baseline to work from.

#2 Train personnel in tailoring guidance. Need more practical guidance.

#4 Train engineering personnel on writing pollution prevention specifications. Need a dedicated manufacturing group to evaluate processes and cost effectiveness. Need mandatory pollution prevention training.

#1 Pollution prevention as contract requirement to pay for services rendered.

Establish a clause for new contracts and include pollution prevention as a separate line item. Budget for pollution prevention in new contracts. Pollution prevention specifications should be tailored for specific program.

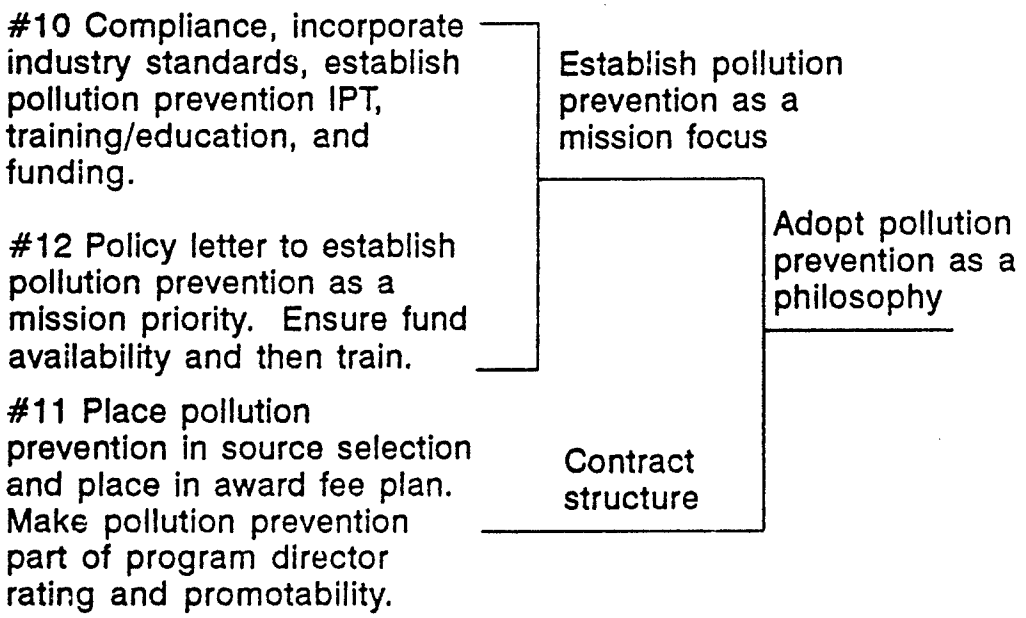
Establish a structure which allows for more cost effective information sharing

Organize and train personnel

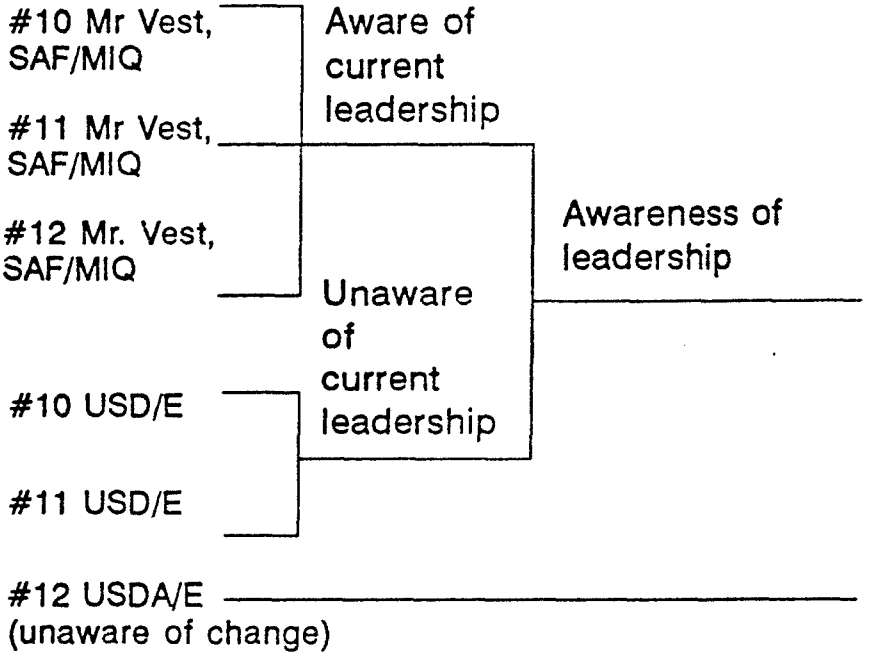
Establish pollution prevention as a contract requirement

Through the first three phases establish pollution prevention in the RFP

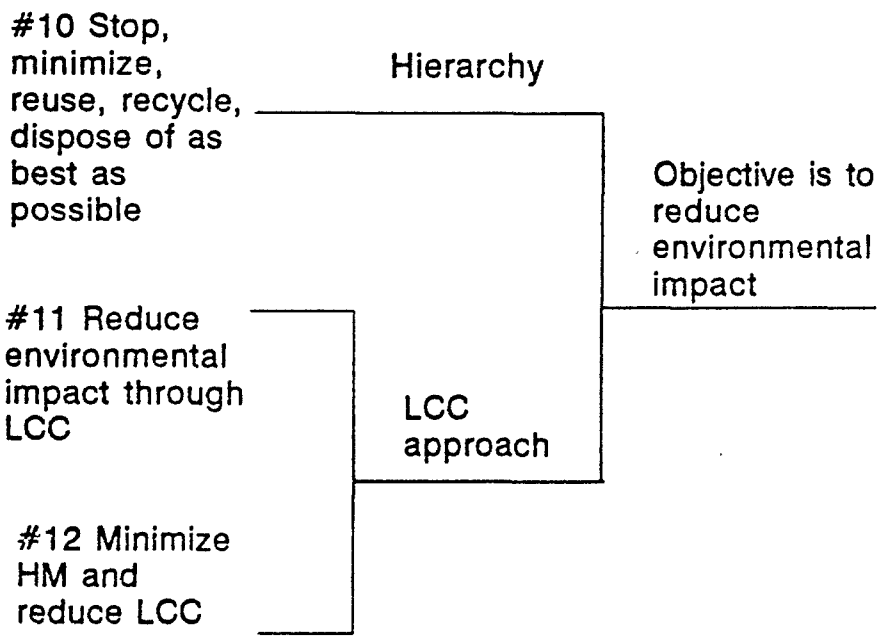
Appendix C: Dendogram Analysis
Incentives Question 4-Strategic



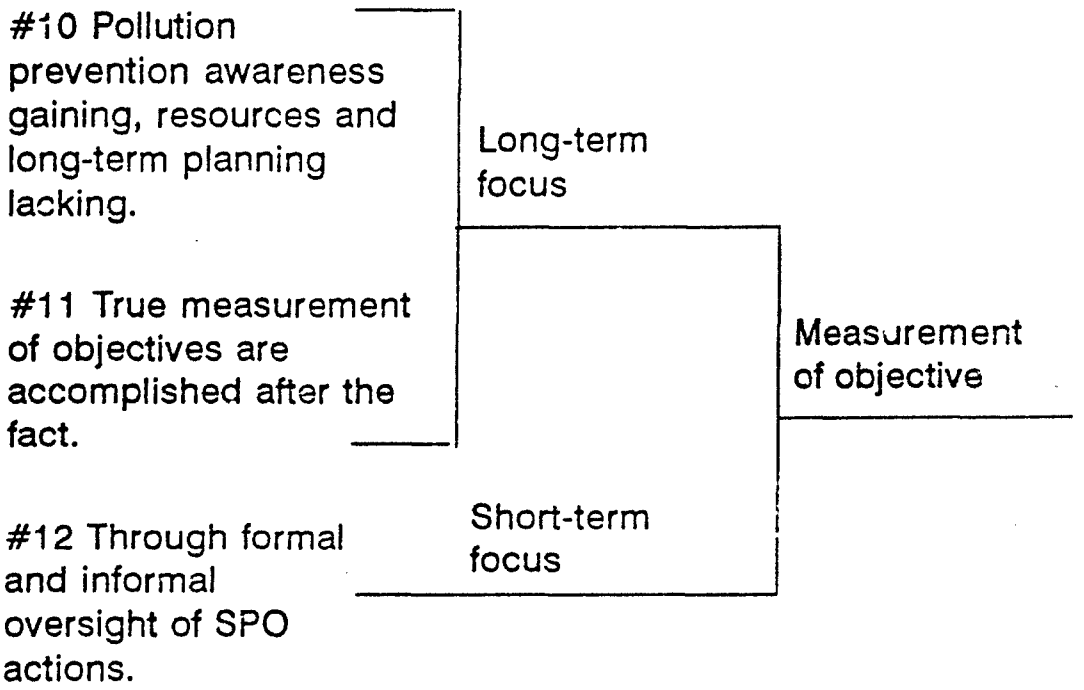
Appendix C: Dendogram Analysis
Awareness Question 1-Strategic



Appendix C: Dendogram Analysis
Awareness Question 2-Strategic



Appendix C: Dendogram Analysis
Awareness Question 5-Strategic



Appendix D: Incentive Matrix Displays

	Award Fee Incentive
Contracting Management	
#5	Award fee would work as a contract incentive if measurable, quantifiable, and provable cost benefits could be developed.
#6	Respondent was skeptical that award fees would work, believes award fees rarely work as intended. Additional pools of money are not available to make it a viable incentive..
#8	Award fee would work if pollution prevention criteria could be developed.
#9	Award fee is the "Best Way" to reward contractors for developing pollution prevention initiatives, but it would not work well for every system program office. Contractors should receive a fee based on their efforts at controlling pollution.
#13	Award fee can be a powerful incentive tool. However, ongoing programs would have to design a specific incentive provision and then modify their contracts in order to use the provision.
Environmental Management	
#1	Too subjective to work as an incentive.
#2	Does not recommend the use of award fees as an incentive.
#3	Would work if objective criteria for determining the payment of the award fee can be developed.
#7	Mixed opinion. On one hand, an award fee would work if pollution prevention criteria was placed on equal footing with cost, schedule, and performance criteria. Without equal footing and the development of objective criteria, leadership will not place a high enough dollar value on pollution prevention. Thus, minimizing the impact it would have in motivating the contractors to focus on pollution prevention.
#4	Likes award fee because of the reward it offers the contractor.

	Award Fee Incentive
Strategic Management	
#10	Source reduction should be included as an award fee factor in contracts.
#11	Provides a lot of leverage (but also requires money).
#12	Tie the fee to the amount of money the contractor saves the government over the life cycle of the system. In other words, provide the contractor a fee equal to a percentage of the funds they save the government using a life cycle cost perspective.

	Value Engineering Change Proposal (VECP) Incentive
Contracting Management	
#5	Could work as an incentive, however, experience shows that VECP is a rarely if ever used contract provision. Thus, contract initiatives would not occur and big rewards would not be reaped from its implementation.
#6	VECP is the best incentive vehicle--It is a broad based clause that has built in motivation and already exists in most contracts. Thus, the clause could be used as written and would not require any modification.
#8	VECP could only work in Firm-Fixed-Price type contracts. Therefore, this provision would not work as an incentive in weapon system development contracts.
#9	This provision would not work well since it is rarely used today. However, with reduced DoD funding, the clause may begin to play a bigger role in the future. Therefore, VECP may be worth considering as an incentive. It would be especially easy to implement since most SPOs have established mandatory VECP programs.
#13	Suggests not relying on VECP as an incentive provision because the government lacks control. That is, the government can not force the contractor to submit VECP initiatives.
Environmental Management	
#1	Experience shows that it takes a great deal of time for both the contractor to submit a VECP idea and for the government to in turn evaluate and approve/disapprove the submission. Thus, relying on this provision as the "sole" incentive would not be timely. In short, the "system would bog down" if initiatives started rolling in from contractors.
#2	Does not recommend.
#3	No opinion.
#4	Hated idea of using VECP. It would be impossible to determine the true cost savings.
#7	Leery of using VECP.

	Value Engineering Change Proposal (VECP) Incentive
Strategic Management	
#10	This is the tool to use to effect change for better non-polluting methods as the technology surfaces.
#11	Too difficult to implement for pollution prevention. The bureaucracy involved in the process of using VECP and negotiating the actual amount of savings is too cumbersome to successfully use as a tool to motivate contractors toward pollution prevention.
#12	No opinion.

	Source Selection (SS) as Incentive
Contracting Management	
#5	Using SS would work, but pollution prevention criteria would represent only a small part of the total picture. The big drivers are technical ability and bid price. Pollution prevention would have little impact in swaying an SS decision.
#6	Provides considerable leverage. Environmental considerations should be included as a factor in the technical portion.
#8	Foresees problems in calling out specifications and materials in selection criteria. For example, what makes one hazardous material better than another and how do you make those types of determinations.
#9	Do not see this as a big player. However, maybe CPARS could be used to evaluate a contractors past environmental performance and that could be used as part of the SS criteria.
#13	This would work for new programs. This incentive could be coupled with a resulting contract that also contains an award fee provision for pollution prevention. The combination of the two would provide the "strongest incentive" possible.
Environmental Management	
#1	This would work well as an incentive since it is early in the systems life cycle.
#2	No opinion.
#3	No opinion.
#4	Prefers SS over the other options given in this question. In fact, stated that adding pollution prevention criteria to a SS was a "must". This is because it occurs early in the life cycle and thus prevents need for expensive redesign to accomplish pollution prevention.
#7	Should only be used if the government can write criteria that categorizes what materials are better than others and how the contractor will be evaluated accordingly. [Note: Similar thought as respondent #8.]

	Source Selection (SS) as Incentive
Strategic Management	
#10	SS criteria should include the non use of hazardous materials and ozone depleting chemicals.
#11	At this point, SS offers the best opportunity to design pollution prevention into the contract. At a SS, the contractor would not be evaluated based on each individual hazardous material they proposed to use but rather would be evaluated on their executability of a pollution prevention program.
#12	No opinion.

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Vita

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13. ABSTRACT *(Maximum 200 words)* This research was undertaken to identify positive incentives that would motivate both government personnel and contractors to incorporate pollution prevention into the early design phases of weapon system acquisitions. The adoption and implementation of such incentives would allow the Air Force to reach its pollution prevention objectives more efficiently. A literature search revealed little information on the pollution prevention program in the military. In contrast much information was found concerning military cleanup activities. As a result, in-depth personal interviewing was used to measure pollution prevention awareness in Aeronautical Systems Center program offices. Interviews, analysis, and comparisons were made between three groups consisting of contracting, environmental, and strategic management personnel. Analysis revealed four main themes: program training; program funding; program structure; and contract incentives. Formal training and education on pollution prevention were limited. Current funding was done through existing resources. This had a potential detrimental effect on normal programming. The structure and philosophy of the current pollution prevention program are in preliminary stages, but is progressing. Finally, positive incentives were not being used to motivate personnel to design in pollution prevention.

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